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Stauff Accumulators




Introduction

Bladder accumulators provide a means of regulating the performance of a hydraulic system.

They are suitable for storing energy under pressure, absorbing hydraulic shock, dampening pump pulsation and flow fluctuations.

Bladder accumulators provide excellent gas and fluid separation ensuring dependable performance, maximum efficiency, and long service life.

Why use a Bladder Accumulator?

- Improves your systems efficiency
- Supplements your pump flow
- Supplies extra power in an emergency
- Compensates for any system leakage
- Absorbs hydraulic shocks
- Accepted world wide
- High/Low temperature tolerance
- Extremely safe (can not disassemble under pressure)
- Quick response
- Wide range of compounds for a variety of fluids

Accumulator Function

The design of the Stauff bladder accumulator makes use of the difference in the compressibility between a gas (nitrogen) and a liquid (hydraulic fluids). The bladder contained in the shell is pre-charged with nitrogen gas to a pressure determined by the work to be done.

After pre-charging, the bladder occupies the entire volume of the shell, from there the work can be split into three steps.

Step 1.
When the hydraulic fluid enters the accumulator, the nitrogen contained in the bladder is compressed and its pressure is increased.

Step 2.
The compression of the bladder stops when the pressure of the fluid and nitrogen are equal (balanced). During this step the bladder is not subject to any abnormal mechanical stress.

Step 3.
On demand, as system pressure falls, the accumulator's stored fluid is returned to the system under pressure applied by the compressed nitrogen. On completion of the hydraulic system functions, the accumulator reverts to step 1.

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Stauff Bladder Accumulators

Stauff STA-S Series

Design Features & Benefits

3000 PSI / 207 Bar Bottom Repairable

3000 PSI / 207 Bar Bottom Repairable High Flow

3000 PSI / 207 Bar Top Repairable

5000 PSI / 345 Bar Bottom Repairable High Flow

Bladder Accumulator Order Code Type STBA

Technical Data & Dimensions Replacement Bladders
3000 PSI / 5000 PSI - 207 / 345 Bar

Replacement Bladders Order Code Type STB

Charge Kits, Repair Kits, Port Adaptors & Safety Valves

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Stauff Diaphragm Accumulators

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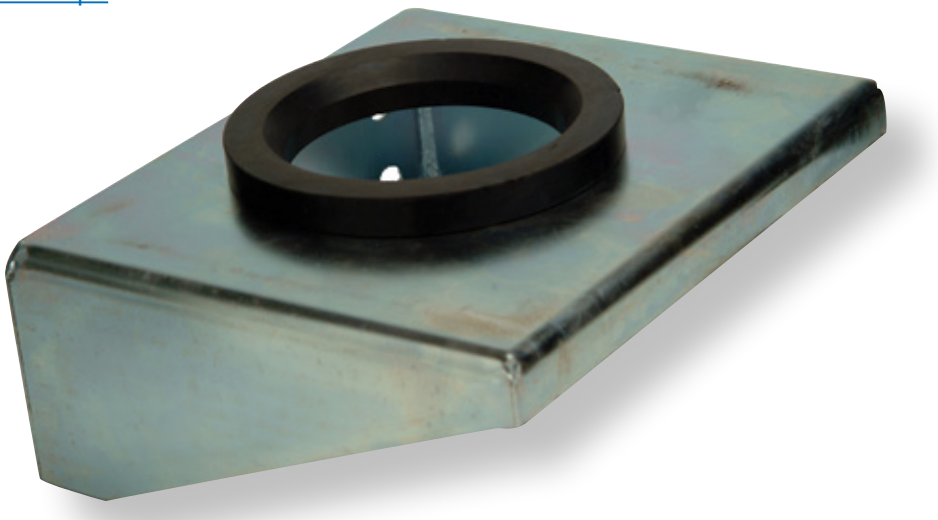
Stauff Accumulator Accessories

Accumulator Brackets Type AMP & AMP/D

Base Brackets & Rubber Rings Type BB & RR Series

Mounting Brackets Compatibility Information for Bladder Accumulators

Dimensions & Order Code Round Steel U-Bolt Clamps Type RBD



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Stauff Bladder Accumulator Operating & Maintenance

Stauff Diaphragm Accumulator Operating & Maintenance

Guidelines for Selection, Installation and Operation

Operating & Maintenance Instructions

Pre-Charging Diaphragm Accumulators

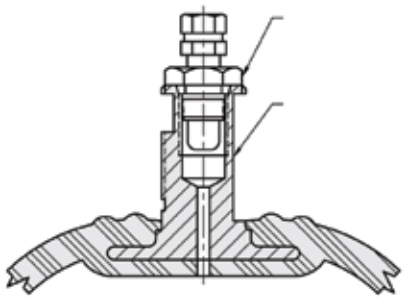
US Style Cored Gas Valve

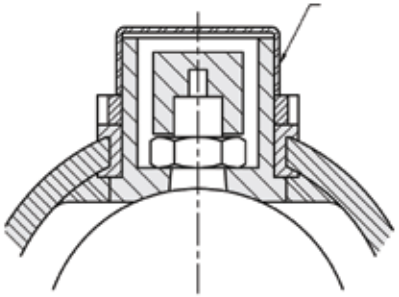
Metric M28 x 1.5 Gas Valve

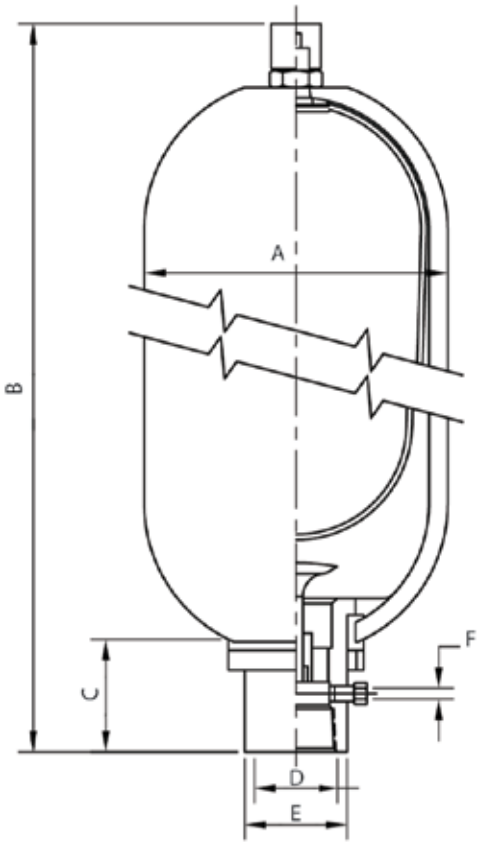
Checking Pre-Charge Pressure

Metric M28 x 1.5 Gas Valve

US Style Cored Gas Valve







Accumulators and Accessories

Bladder Accumulators

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Stauff STA-S Series

Material Options & Features

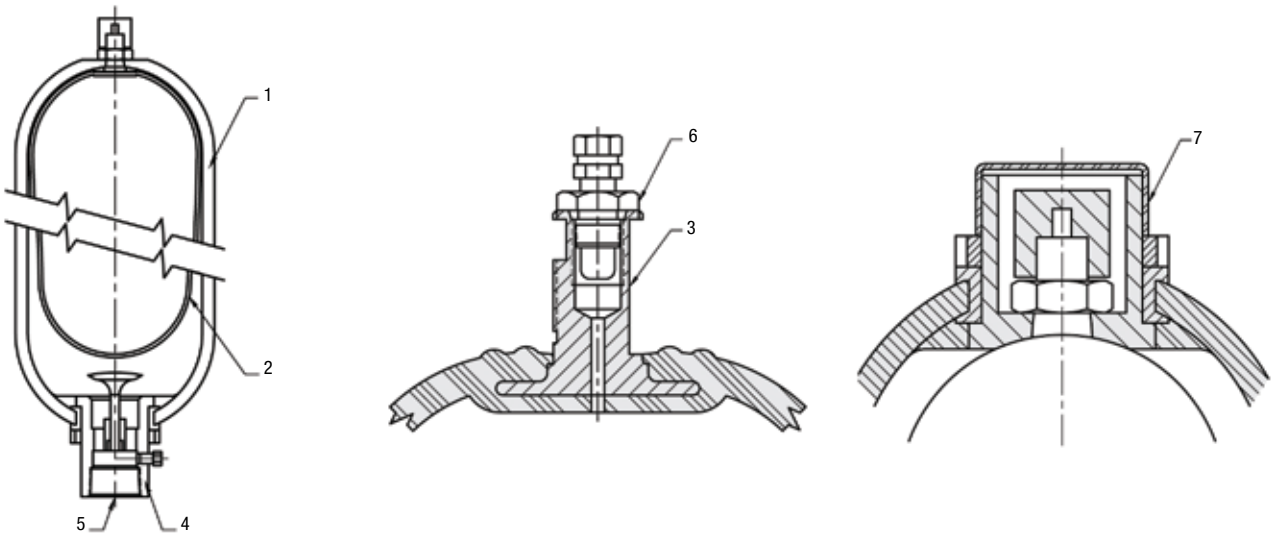
Main Components	Standard Material			Material Options			Features
Shell	Chrome-Mollybdenum Alloy Steel (SA-372) All sizes comply with ASME materials specifications Black Epoxy coating			Consult factory for details			Meets 4:1 safety requirements Seamless shell 1 Gallon and larger supplied with ASME Certification
Bladder		Temp ˚C	Rating ˚F	EPDM (D) Consult factory for other options	Temp ˚C	Rating ˚F	With molded steel valve stems Wide range of materials and temperature ranges
	Nitrile (N) (Buna N)	-23 ... +104	-10 ... +220		-48 ... 166	-55 ... +330	
	Low Temp Nitrile (L)	-51 ... +93	-60 ... +200				
	FPM (F) (Viton)	-17 ... +176	0 ... +350				
Oil Port Assembly	Carbon Steel ANSI 4130 Material Specification Black Phosphate coating			Consult factory for other options			Proven design and reliability Many port options available High flow option

Bladder Accumulator Features

- Meets A.S.M.E. specifications
- 4:1 design factor at normal operating pressures.
- Also available with foreign certificates (upon request)
- Interchangeable with most competitor's units.
- All standard accumulators available from stock.

Size (Gallon)	Maximum Recomended Flow	
	GPM	LPM
1 Qt	40	150
1	150	565
2.5 - 15	220	830
2.5 - 15 High Flow	396	1495

Design Features & Benefits



1. Shell
STAUFF accumulator shells are made from Chrome-Molybdenum Alloy Steel (SA372) with forged ends for maximum strength providing a minimum 4 to 1 design factor at normal operating pressures. All sizes comply with ASME material specifications, 1 gallon & larger are supplied with ASME Certifications upon request.

2. Bladder
STAUFF bladders are manufactured from the most advanced elastomers which are capable of meeting a wide range of systems requirements. Bladders are offered in a variety of compounds to meet a wide range of fluids and operating temperatures. STAUFF can supply Buna, Low Temperature Buna and Viton bladders from stock.

3. Bladder Stems
All bladder accumulators, sizes 1 gallon and larger, are fitted as standard with a two-piece bladder stem and a replaceable gas valve cartridge for ease of serviceability.

4. Port Assemblies
Standard oil service ports are made from high-strength alloy steel for maximum durability.

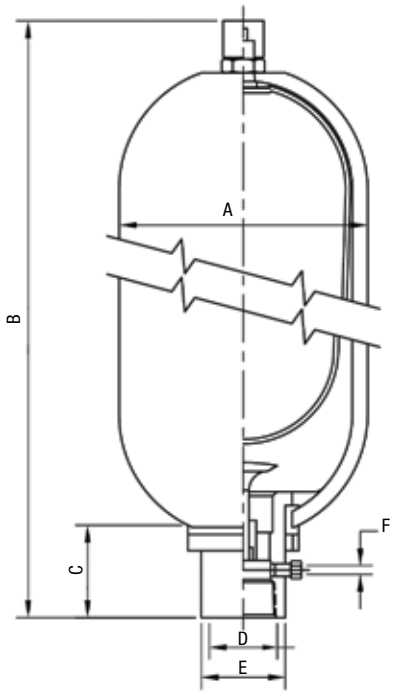
5. Fluid Ports
SAE straight thread (standard), NPT and Split Flange Adaptors are available (See page 11). A Bleed Port (plugged) is included as standard on all accumulator sizes 1 gallon and larger.

6. Gas Valve
All accumulators are fitted with a gas valve for ease of gas pre-charging. One-gallon and larger units are equipped with a cored gas valve cartridge (ISO-4570-8V1) for ease of maintenance. 5000 PSI units are equipped with a high pressure cored gas valve cartridge (Mil. Spec. M6164-2). For safety, the gas valve vents if unscrewed.

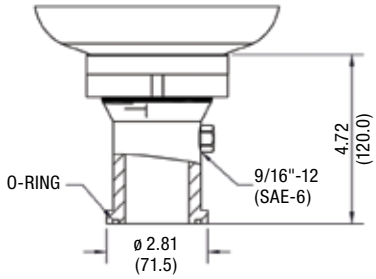
7. Top Repairable
The top repairable design permits easy maintenance of the Accumulator Bladder without removing the accumulator from service, thus minimizing costly downtime.

3000 PSI / 207 Bar Bottom Repairable

Dimensions



Installation Note:
Leave approximately 8" (200mm) for installation of gas charging valve.



Optional Split Flange Adapter Port. For use with 2" SAE code 61 split flange (not included).

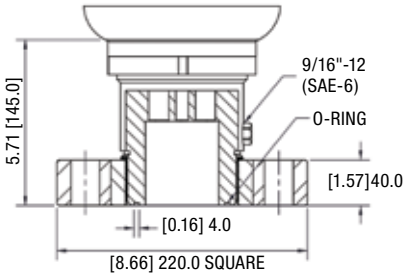
Nominal Capacity (Gallons/Liter)	Gas Volume (in^3/cm^3)	Maximum Working (PSI/Bar)	Dimensions (mm/in)							Net Weight (Kg/Lb)
			A	B	C	D SAE	D NPT	E	F SAE	
*1 Qt.	67.1	3000	114	291	50	SAE-12 (1-1/16" - 12)	3/4"	42	N/A	4.5
1.0	1190	207 .	4.49	11.46	1.97			1.65		10
1.0	234.6	3000	168	420	87	SAE-20 (1-5/8" - 12)	1-1/4"	60	SAE-6 (9/16"-18)	15
4.0	3845	207	6.8	16.55	3.42			2.36		34
2.5	587	3000	229	850	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 9/16"-18)	36
10	9620	207	9.02	33.46	3.54			3.00		79
5	1132	3000	229	1245	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	54
20	18548	207	9.02	49.02	3.54			3.00		119
10	2075	3000	229	1390	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	100
40	34000	207	9.02	54.72	3.54			3.00		220
11	2514	3000	229	1530	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	109
44	41210	207	9.02	60.24	3.54			3.00		240
15	3234	3000	229	1975	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	138
60	53000	207	9.02	77.76	3.54			3.00		304

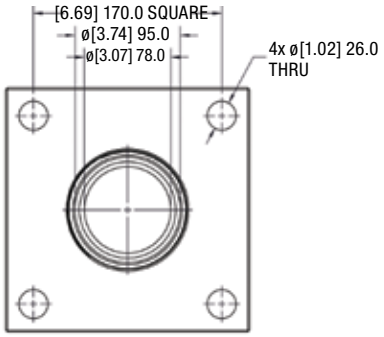
* In accordance with ASME VII calculations only

3000 PSI / 207 Bar Bottom Repairable High Flow

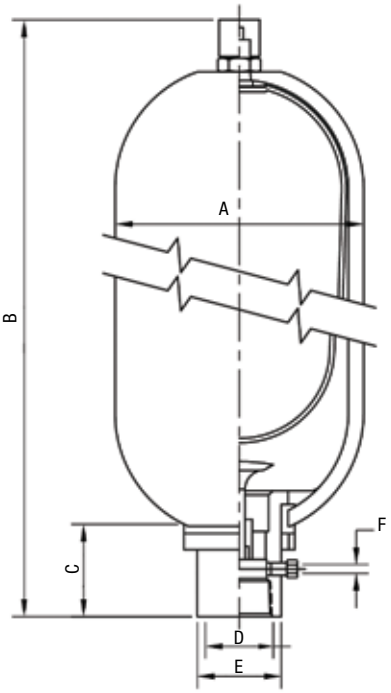
Dimensions

Optional Split Flange Adapter Port. For use with 2" SAE code 62 split flange (not included).





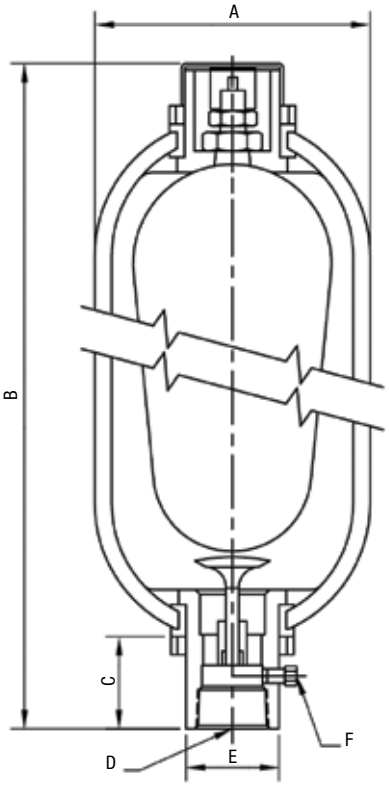
Installation Note:
Leave approximately 8" (200mm) for installation of gas charging valve.



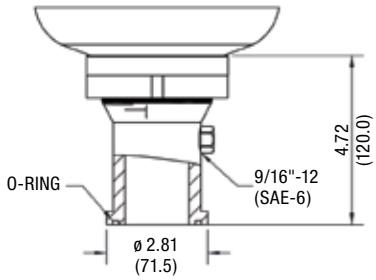
Nominal Capacity (Gallons/Liter)	Gas Volume (in^3/cm^3)	Maximum Working (PSI/Bar)	Dimensions (mm/in)						Net Weight (Kg/Lb)
			A	B	C	D NPT	E	F SAE	
2.5	587	3000	229	608	155	3-1/2" Male or 3" Female	108	SAE-6 (9/16"-18)	37
10	9620	207	9.02	23.94	6.10		4.25		82
5	1132	3000	229	913	155	3-1/2" Male or 3" Female	108	SAE-6 (9/16"-18)	55
20	18548	207	9.02	35.95	6.10		4.25		121
10	2075	3000	229	1438	155	3-1/2" Male or 3" Female	108	SAE-6 (9/16"-18)	101
40	34000	207	9.02	56.61	6.10		4.25		223
11	2514	3000	229	1588	155	3-1/2" Male or 3" Female	108	SAE-6 (9/16"-18)	110
44	41210	207	9.02	62.52	6.10		4.25		243
15	3234	3000	229	2043	155	3-1/2" Male or 3" Female	108	SAE-6 (9/16"-18)	139
60	53000	207	9.02	80.43	6.10		4.25		306

3000 PSI / 207 Bar Top Repairable

Dimensions



Installation Note:
Leave approximately 8" (200mm) for installation of gas charging valve.



Optional Split Flange Adapter Port. For use with 2" SAE code 61 split flange (not included).

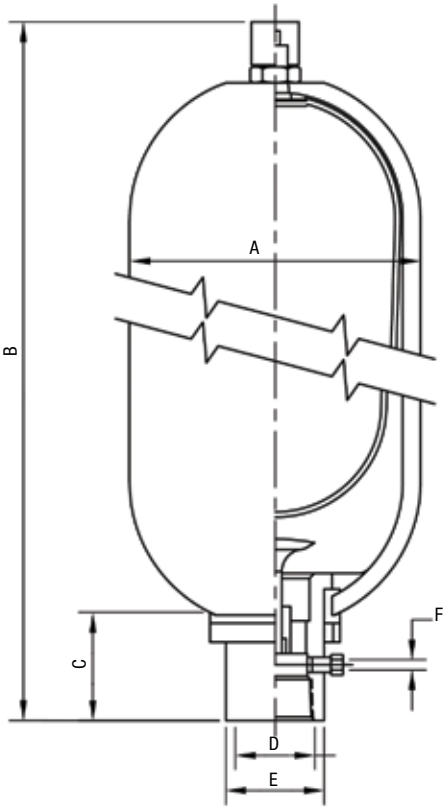
Nominal Capacity (Gallons/Liter)	Gas Volume (in^3/cm^3)	Maximum Working (PSI/Bar)	Dimensions (mm/in)							Net Weight (Kg/Lb)
			A	B	C	D SAE	D NPT	E	F SAE	
2.5	587	3000	229	541	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 9/16"-18)	36
10	9620	207	9.02	21.30	3.54			3.00		79
5	1132	3000	229	841	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	54
20	18548	207	9.02	33.11	3.54			3.00		119
10	2075	3000	229	1521	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	100
40	34000	207	9.02	59.88	3.54			3.00		220
11	2514	3000	229	1521	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	109
44	41210	207	9.02	59.88	3.54			3.00		240
15	3234	3000	229	1976	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	138
60	53000	207	9.02	77.80	3.54			3.00		304

Consult factory for other sizes

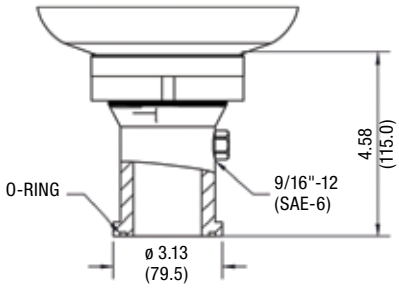
5000 PSI / 345 Bar Bottom Repairable

Dimensions

Installation Note:
Leave approximately 8" (200mm) for installation of gas charging valve.



Optional Split Flange Adapter Port. For use with 2" SAE code 62 split flange (not included).



Nominal Capacity (Gallons/Liter)	Gas Volume (in³/cm³)	Maximum Working (PSI/Bar)	Dimensions (mm/in)							Net Weight (Kg/Lb)
			A	B	C	D SAE	NPT	E	F SAE	
2.5	587	5000	245	560	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 9/16"-18)	57
10	9620	345	9.65	22.05	3.54			3.00		126
5	1132	5000	245	870	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	91
20	18548	345	9.65	34.25	3.54			3.00		200
10	2075	5000	245	1395	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	159
40	34000	345	9.65	54.92	3.54			3.00		350
15	3234	5000	245	1990	90	SAE-24 (1-7/8" - 12)	2"	76	SAE-6 (9/16"-18)	227
60	53000	345	9.65	78.35	3.54			3.00		500

Consult factory for other sizes

Bladder Accumulator ▪ Type STBA

Order Codes

STBA	H	-	010	-	3000	S	B	/	N	U	C	7	C	/	N	C	/	C
①	②		③		④	⑤	⑥		⑦	⑧	⑨	⑩	⑪		⑫	⑬		⑭

① Model Code

Bladder Accumulator	**STBA**

② Accumulator Type

Standard	**Omit**
Hi Flow	**H**

③ Size

Volume (Gal)	Size
1 Quart	**001**
1 Gallon	**004**
2.5 Gallon	**010**
5 Gallon	**020**
10 Gallon	**035**
11 Gallon	**040**
15 Gallon	**055**

④ Pressure Rating According to Standard

3000 PSI / 207 Bar	**3000**
5000 PSI / 345 Bar	**5000**

⑤ Design Approval

ASME	**S**

This catalog relates to ASME certified accumulators. ASME certifications are available upon request. Please request at the time of ordering.
CE PED (Europe), AS1210 (Australia) and GB/T 20663 (China) certified accumulators are also available. Please consult STAUFF for details.

⑥ Bottom or Top Repairable

Bottom Repairable	**B**
Top Repairable	**T**

⑦ Bladder Material

Nitrile (Buna N)	**N**
Low Temp Nitrile	**L**
EPDM	**D**
FPM	**F**

Please consult STAUFF for availability of other materials

⑧ Gas Valve Connection

Cored gas valve for 3000 PSI Accumulators	**U**
Military Style Gas Valve for 5000 PSI Accumulators	**M**

⑨ Gas Valve Material

Carbon Steel (Standard)	**C**

Consult STAUFF for availability of other materials

⑩ Bladder Stem Size

5/8"-18 UNF (For use with 1 Quart 3000 PSI)	**5**
7/8"-14 UNF (For use with 1 Gal to 15 Gal 3000 PSI)	**7**
2"-12 UNF (For use with 5000 PSI)	**2**

⑪ Bladder Stem Material

Carbon Steel (Standard)	**C**

Please consult STAUFF for availability of other materials

⑫ Fluid Port Connection

SAE Threaded	**U**
NPT	**N**
1-1/2" SAE Code 61 Split Flanged (3000 PSI)	**S**
1-1/2" SAE Code 62 Split Flanged (6000 PSI)	**F**
Four Bolt Flange (High Flow)	**H**

⑬ Material

Carbon Steel (STD)	**C**

Please consult STAUFF for availability of other materials

⑭ Material or Coating of the Shell

Carbon Steel, Black Epoxy Coated (STD)	**C**

Please consult STAUFF for availability of other materials

Availability Chart

Size Code	Gallons (Ltrs) Volume	3000 PSI Bottom Repairable	3000 PSI Bottom Repairable High Flow	3000 PSI Top Repairable	5000 PSI Bottom Repairable
001	1 Quart (1 Litre)	Yes	N/A	N/A	N/A
004	1 Gallon (4 Litre)	Yes	N/A	N/A	N/A
010	2.5 Gallon (10 Litre)	Yes	Yes	Yes	Yes
020	5 Gallon (20 Litre)	Yes	Yes	Yes	Yes
035	10 Gallon (35 Litre)	Yes	Yes	N/A	Yes
040	11 Gallon (40 Litre)	Yes	Yes	Yes	N/A
055	15 Gallon (55 Litre)	Yes	Yes	Yes	Yes

Fluid Port Connections

	Size Code	1 Qrt	1 Gal	2.5 to 15 Gal	High Flow 2.5 to 15 Gal
Threaded SAE	U	SAE 12 (1-1/16"-12)	SAE 20 (1-5/8"-12)	SAE 24 (1-7/8"-12)	N/A
NPT	N	3/4	1-1/4	2"	3.5" Male
	N1	N/A	N/A	N/A	3" Female
Split Flanged Code 61 - 3000 PSI	S	N/A	N/A	1-1/2"	N/A
Split Flanged Code 62 - 6000 PSI	F	N/A	N/A	1-1/2"	N/A
Four Bolt Flange	H	N/A	N/A	1-1/2"	See page 5

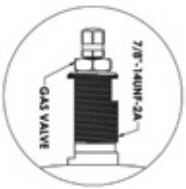
3000 PSI / 5000 PSI - 207 / 345 Bar

Stauff offers a wide range of bladder materials to suit most applications.
Stauff bladder kits include
Qty (1) Bladder with molded valve stem
Qty (1) Gas valve and O-Ring
Qty (1) Poppet valve O-Ring
Qty (1) Back up seal O-Ring
See the technical appendix for more information

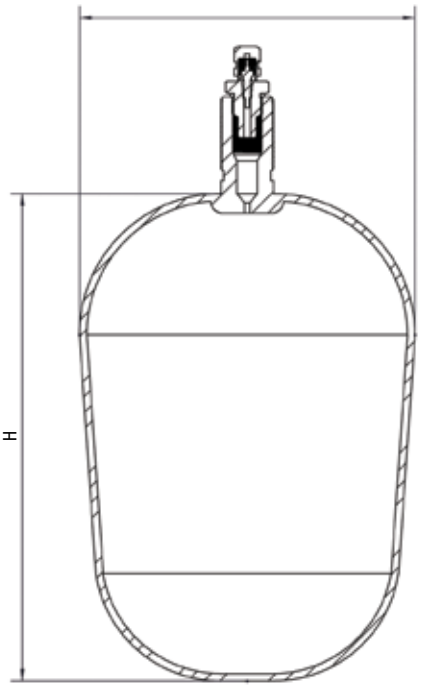
	Temperature Rating	
	˚C	˚F
Nitrile (N) (Buna N)	-23 ... +104	-10 ... +220
Low Temp Nitrile (L) FPM (F)	-51 ... +93	-60 ... +200
Viton	-17 ... +176	0 ... +350
EPDM (D) Consult Factory for other options	-48 .. 166	-55 .. +330

1 Qt. Stem Detail
3000 PSI

1 to 15 Gallon
Stem Detail 3000 PSI

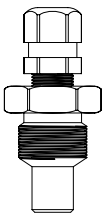


2.5 to 15 Gallon
Stem Detail 5000 PSI



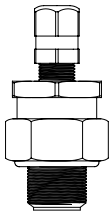
Accumulator Nominal Capacity Gallons/Liter	Dimensions (mm/in)					
	H	D	Stem Thread		Gas Valve	
			3000 PSI	5000 PSI	3000 PSI	5000 PSI
1 Qt.	146 +/- 12.7	95.3	5/8"-18 UNF-2A	N/A	Valve Core STDA-AS-GV-1Qt-P3	N/A
1.0	5.75 +/- 0.5	3.75				
1.0	203 +/- 12.7	139.7	7/8"-14 UNF-2A	N/A	Valve Cartridge STA-AS-GV-1-15-P3	N/A
4.0	8.0 +/- 0.5	5.50				
2.5	292 +/- 12.7	203	7/8"-14 UNF-2A	2"-12 UN-2A	Valve Cartridge STA-AS-GV-1-15-P3	Valve Cartridge STA-AS-GV-1-15-P5
10	11.50 +/- 0.5	8.0				
5	584 +/- 25.4	203	7/8"-14 UNF-2A	2"-12 UN-2A	Valve Cartridge STA-AS-GV-1-15-P3	Valve Cartridge STA-AS-GV-1-15-P5
20	23.0 +/- 1.0	8.0				
10	1105 +/- 25.4	203	7/8"-18 UNF-2A	2"-12 UN-2A	Valve Cartridge STA-AS-GV-1-15-P3	Valve Cartridge STA-AS-GV-1-15-P5
35	43.5 +/- 1.0	8.0				
11	1257 +/- 25.4	203	7/8"-14 UNF-2A	2"-12 UN-2A	Valve Cartridge STA-AS-GV-1-15-P3	Valve Cartridge STA-AS-GV-1-15-P5
40	49.5 +/- 1.0	8.0				
13	1626 +/- 25.4	203	7/8"-18 UNF-2A	2"-12 UN-2A	Valve Cartridge STA-AS-GV-1-15-P3	Valve Cartridge STA-AS-GV-1-15-P5
50	64.0 +/- 1.0	8.0				
15	1727 +/- 25.4	203	7/8"-14 UNF-2A	2"-12 UN-2A	Valve Cartridge STA-AS-GV-1-15-P3	Valve Cartridge STA-AS-GV-1-15-P5
60	68.0 +/- 1.0	8.0				

Stauff accumulators and replacement bladder kits are shipped with industry standard gas valves and protective caps.



3000 PSI Cored Gas Valve
Cartridge (ISO-4570-8V1)
Stauff Part Number
STA-AS-GV-1-15-P3

For 3000 PSI Accumulators,
1 Gallon to 15 Gallon



5000 PSI Valve Cartridge
Stauff Part Number
STA-AS-GV-1-15-P5

For 5000 PSI Accumulators,
2.5 Gallon to 15 Gallon

Replacement Bladder ▪ Type STB

Order Codes

STB	-	010	-	3000	/	N	U	C	7	C
①		②		③		④	⑤	⑥	⑦	⑧

① Model Code

Bladder Kit	**STB**

② Size

Volume (Gal)	Code
1 Quart	**001**
1 Gallon	**004**
2.5 Gallon	**010**
5 Gallon	**020**
10 Gallon	**035**
11 Gallon	**040**
15 Gallon	**055**

③ Pressure Rating According to Standard

3000 PSI / 207 Bar	**3000**
5000 PSI / 345 Bar	**5000**

④ Bladder Material

Nitrile (Buna N)	**N**
Low Temp Nitrile	**L**
EPDM	**D**
FPM	**F**

Please consult STAUFF for availability of other materials

⑤ Gas Valve Connection

Cored gas valve for 3000 PSI Accumulators	**U**
Military Style Gas Valve for 5000 PSI Accumulators	**M**

⑥ Gas Valve Material

Carbon Steel (Standard)	**C**

Consult STAUFF for availability of other materials

⑦ Bladder Stem Size

5/8"-18 UNF (For use with 1 Quart 3000 PSI)	**5**
7/8"-14 UNF (For use with 1 Gal to 15 Gal 3000 PSI)	**7**
2"-12 UNF (For use with 5000 PSI)	**2**

⑧ Bladder Stem Material

Carbon Steel (Standard)	**C**

Please consult STAUFF for availability of other materials

Stauff Bladder Kits include:
Qty (1) Bladder with molded valve stem
Qty (1) Gas valve and O-Ring
Qty (1) Poppet valve O-Ring
Qty (1) Back up seal O-Ring

Please see the maintenance instructions on page 20 for details

Charging Kit

STBA-CK-B/T-P3
Charging Kit for Bottom and Top Repairable
3000 PSI Accumulators
Includes:
- STBA-PC2157 Charge Valve assembly and test point
- SPG-063-0250-01-P-B04 Gauge 0 to 3625 PSI (0 to 250 bar)
- STBA-P3-3048MM-B 3000 PSI Nitrogen bottled adapter and hose assembly, 3048mm (12 in) long
- STBA-50019 Fitting Adaptor, .305-32 UNS (female) to 5/8"-18-2AUNF (Male)
- STBA-10143 Fitting Adaptor, 7/8"-14 UNF (female) to 5/8"-18-2AUNF (Male)
- STBA-VLV-EXT-1 Gas Valve Extension for 3000 PSI Top Repairable Accumulator
- STBA-C-1 Case with foam

STBA-CK-B-P5
Charging Kit for Bottom Repairable
5000 PSI Accumulators
Includes:
- STBA-PC2157 Charge Valve assembly and test point
- SPG-063-0400-01-P-B04 Gauge 0 to 5800 PSI (0 ... 400 bar)
- STBA-P5-3048MM-B 5000 PSI Nitrogen bottled adapter and hose assembly, 3048mm (12 in) long
- STBA-50019 Fitting Adaptor, .305-32 UNS (female) to 5/8"-18-2A UNF (Male)
- STBA-C-1 Case with foam

Repair Kit

Repair Kit Part # STA-R-1
Repair kit includes the following parts:
- Set of pull rods
- Set of hydraulic valve wrenches
- Set of gas valve tools
- Case and foam

Accumulator Safety Valve

Accumulator Safety Valves
- Provides manual isolation of the accumulator from the hydraulic circuit
- Integrated relief valve to protect the accumulator from over pressure
- Available with manual or electric dump vavles
- Consult STAUFF formore information

Port Adaptors (SAE to Flange)

Code #61 (3000 PSI)

SAE to Split Flange Connector	
Part #	**Description**
302-12-12	#12 SAE to 3/4" Flange
302-20-20	#20 SAE to 1-1/4" Flange
302-24-24	#24 SAE to 1-1/2" Flange

Code #61 (3000 PSI)

Split Flanges	
Part #	**Description**
DB-302--AS-U-B#K	3/4" Split Flange
DB-304--AS-U-B#K	1-1/4" Split Flange
DB-305--AS-U-B#K	1-1/2" Split Flange

Code #62 (6000 PSI)

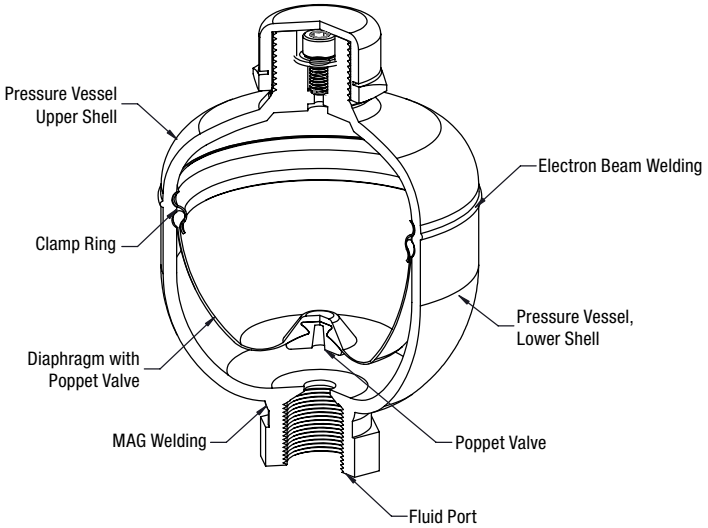
SAE to Split Flange Connector	
Part #	**Description**
602-12-12	#12 SAE to 3/4" Flange
602-20-20	#20 SAE to 1-1/4" Flange
602-24-24	#24 SAE to 1-1/2" Flange

Code #62 (6000 PSI)

Split Flanges	
Part #	**Description**
DB-602-AS-U-B#K	3/4" Split Flange
DB-604--AS-U-B#K	1-1/4" Split Flange
DB-605--AS-U-B#K	1-1/2" Split Flange

Diaphragm Accumulator ▪ STDA Series

Technical Data



Technical Data

- Electron Beam Welded Construction
- High Strength Alloy Steel Shell
- Compact Design
- Operating Pressure to 3600 PSI (250 Bar)
- Capacity up to 3.5 Liters
- Hydrin (ECO) Diaphragm Material (Standard)
- Operating Temperature Range -40° ... +80°C / (-40° ... +170°F)
- Low Permeation Coefficient
- Up to 1:8 Compression Ration (Precharge/Maximum Working)
- UNF Oil Port Connection (Standard)
- Conforms to CE97/23
- Corrosion Resistant Black Gloss Finish
- Metric Gas Valve (Standard)

Main Components	Standard Material			Material Options
Shell	High Strength Alloy Steel Black Enamel Coating (Non-repairable electron-beam welded construction)			Consult factory
Diaphragm	Eco (Hydrin)	Temperature Rating ˚C: -40 ... +80	Temperature Rating ˚F: -40 ... +176	Consult factory for other options
	NBR (Nitril-Buna-N)	-10 ... +80	+14 ... +176	
Shut-Off Button	Delrin			Consult factory
Gas Valve	M28 x 1.5			US Style Gas Valve For Hermetically Sealed or other options, please consult the factory
Fluid Port	Steel			Consult factory

Options

Gas Port

- Precharged Hermetically Sealed (non-rechargeable)
- US Style Gas Valve

Oil Port

- BSP, Metric, Male/Female Metric Combination, ORFS

Diaphragm Material

- Nitrile (Buna)
- Fluroelastomer (Viton)
- Other materials upon request

Why use a Diaphragm Accumulator?

- Compact & Lightweight Design
- Fast Response Time
- Cost Effective
- Supplements Pump Flow
- Extends System Life
- Absorbs Shock
- Contamination Tolerant

Diaphragm Accumulator Features

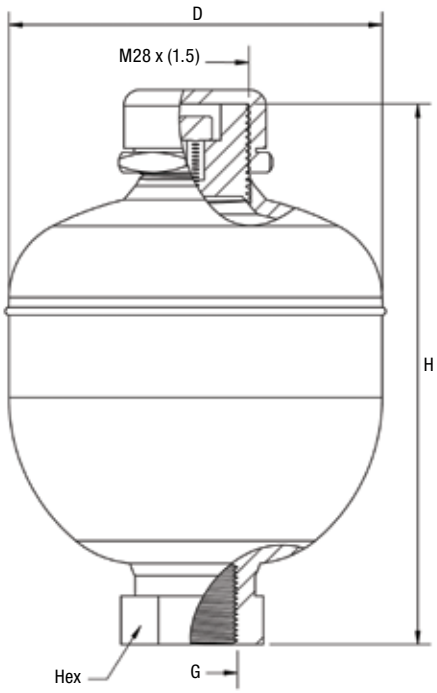
- Maximum compression ratio = 1 : 8
  (maximum working pressure / pre-charge pressure)
  Refer to Stauff catalog for individual accumulator compression ratios.
- Compact and light weight
- Cost effective
- Non-repairable design
- Interchange with most competitor's units
- All standard accumulators available from stock.

Maximum Flow Rates

Size (Liters)	Max. Recommended Flow			
	Normal Operation		When fully discharging	
	GPM	LPM	GPM	LPM
0.075 & 0.16	11	40	2.6	10
0.32 & 1.40	26	100	11	40
2.00 & 3.50	42	160	16	60

Diaphragm Accumulator ▪ STDA Series

Dimensions



Nominal Size Code	Gas Volume (in³/litre)	Maximum Working Pressure (PSI/Bar)	Test Pressure (PSI/Bar)	Maximum ΔP Dynamic (PSI/Bar)	Maximum Gas Pre-Charge (PSI/Bar)	Maximum Compression Ratio	Dimension (mm/in)		Oil Port		Net Weight (Kg/Lb)
							H	D	G Female	Hex (mm/in)	
007	4.6	3625	5439	2031	1885	1:8	111	64	SAE-6 (9/16"-18)	32	0.7
	0.075	250	375	140	130		4.35	2.52		1.25	1.54
016	9.8	3625	5439	2031	1885		119	75	SAE-6 (9/16"-18)	32	1
	0.16	250	375	140	130		4.69	2.95		1.25	2.2
032	19.5	3045	4568	1740	1885		134	92.5	SAE-8 (3/4"-16)	32	1.4
	0.32	210	315	120	130		5.28	3.64		1.25	3.08
050	30.5	3045	4568	1450	1885		151	106.7	SAE-8 (3/4"-16)	41	2
	0.5	210	315	100	130		5.95	4.2		1.61	4.4
075	45.8	3045	4568	1483	1885		166	121.5	SAE-8 (3/4"-16)	41	2.6
	0.75	210	315	93	130		6.54	4.78		1.61	5.72
100	61	3045	4568	1667	1885		180	136.2	SAE-8 (3/4"-16)	41	3.5
	1.0	210	315	115	130		7.09	5.06		1.61	7.7
140	85.4	3045	4568	2031	1885		191	147.3	SAE-8 (3/4"-16)	41	6.6
	1.4	210	315	140	130		7.52	5.8		1.61	14.52
200	122	3625	5439	2031	1885		252	156	SAE-12 (1/16"-12)	41	9.2
	2.0	250	375	140	130		9.92	6.14		1.61	20.24
280	170.9	3625	5439	2031	1885	1:6	267	174	SAE-12 (1/16"-12)	41	10
	2.8	250	375	140	130		10.51	6.85		1.61	22
350	213.6	3625	5439	2031	1885	1:4	306	174	SAE-12 (1/16"-12)	41	12.8
	3.5	250	375	140	130		12.05	6.85		1.61	28.16

Consult the factory for additional pressure ratings and port options. Minimum order quanities may be required

Diaphragm Accumulator ▪ STDA Series

Order Codes

STDA	-	075	-	NBR	/	P3	U	M	*	*
①		②		③		④	⑤	⑥	⑦	⑧

① Model Code

STAUFF Non Repairable Diaphragm Accumulator	**STDA**

② Volume

0.075 Liter / 250 Bar	**007**
0.16 Liter / 250 Bar	**016**
0.32 Liter / 210 Bar	**032**
0.5 Liter / 210 Bar	**050**
0.75 Liter / 210 Bar	**075**
1 Liter / 210 Bar	**100**
1.4 Liter / 210 Bar	**140**
2 Liter / 210 Bar	**200**
2.8 Liter / 250 Bar	**280**
3.5 Liter / 250 Bar	**350**

Other pressures available on request.

③ Diaphragm Material

Nitrile	**NBR**
Hydrin for Low Temp	**ECO**
Fluoroelastomer	**FKM**

Other materials available on request.

④ Maximum Working Pressure

210 Bar	**P3**
250 Bar	**P4**

Other pressures available on request.

⑤ Port Options

Connection Style		Volume (Liters)									
Code	**Connection Type**	0.075	0.16	0.32	0.5	0.75	1	1.4	2	2.8	3.5
U**	**UNF**	9/16-18	9/16-18	3/4-16	3/4-16	3/4-16	3/4-16	3/4-16	1 -1/16-12	1 -1/16-12	1 -1/16-12
B*	**BSPP**	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G1/2"	G 1/2"	G 3/4"	G 3/4"	G 3/4"

** Standard for North America
* Consult STAUFF for availability

* Consult STAUFF for additional port options

⑥ Gas Port Connection

M28 x 1.5 (Standard)	**M**
US Style Valve (Uses adaptor)	**U**
Hermetically Sealed	**H**

Note: Minimum order requirement needed for sealed gas port. Consult STAUFF.

⑦ Design Approval

No certification	**Blank**
(1-3.6 ltr) CE Mark	**C**

Please consult STAUFF for other certifications

⑧ Pre-Charge (Factory filled)

Factory filled during manufacture xxx pressure (Bar)	**NXXX**

Gas Valve Conversion Kit

STDA-X-AK
Easily converts the standard M28 X 1.5 gas valve on diaphragm accumulators to the “US Style” cored type gas valve.

Parts included in the adapter kit:

- Aluminum Protective cap (item 7)
- Gas valve adapter assembly with installed gas valve core (item5)
- Gas Valve seal (item4)
- Assembly instructions

- **IMPORTANT: Before installing the new gas valve, make sure the accumulator is isolated from the hydraulic** system and that the gas pressure has been released from the accumulator using the proper charging kit. Please see the operating and maintenance instructions for details.

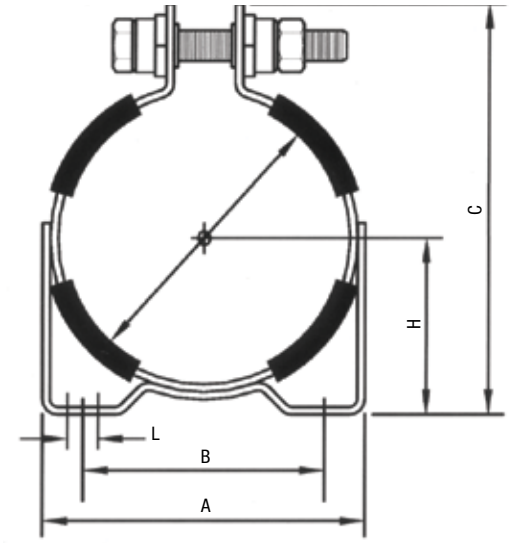
Charging Kit

STDA-CK-M-P3
Charging kit for diaphragm accumulators with the M28 X 1.5 gas Valve 3625 PSI (250 bar) rated
Includes:
- STDA-PCM2155 Charge Valve assembly and test point
- SPG-063-0250-01-P-B04 Gauge 0 ... 3625 PSI (0 ... 250 bar)
- STBA-P3-3048MM-B 3000 PSI Nitrogen bottled adapter and hose assembly, 3048mm (12 in) long
- STDA-AW6MM 6 mm hexagon wrench
- STBA-C-1 Case with foam

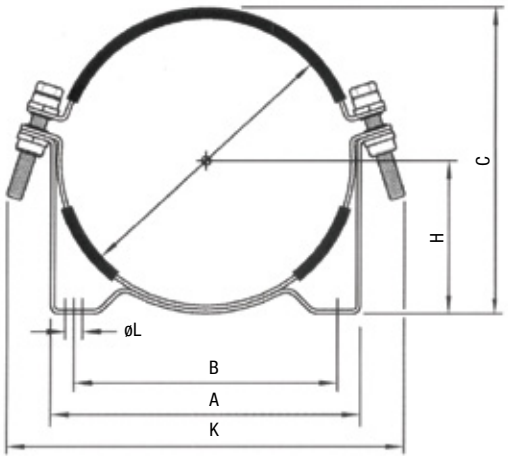
STBA-CK-B-P3
Charging kit for diaphragm accumulators with the US style cored gas valve 3625 PSI (250 bar) rated
Includes:
- STBA-PC2157 Charge Valve assembly and test point
- SPG-063-0250-01-P-B04 Gauge 0 ... 3625 PSI (0 ... 250 bar)
- STBA-P3-3048MM-B 3000 PSI Nitrogen bottled adapter and hose assembly, 3048mm (12 in) long
- STBA-50019 Fitting Adaptor, .305-32 UNS (female) to 5/8"-18-2AUNF(Male)
- STBA-10143 Fitting Adaptor, 7/8"-14 UNF (female) to 5/8"-18-2AUNF (Male)
- STBA-C-1 Case with foam

Accumulator Brackets ▪ Type AMP & AMP/D

Type AMP



Type AMP/D



STAUFF Clamp Part Number	Dimensions (mm/in)						
	"øD" Nom	A	B	C	H	L (Slot)	Width
AMP108	108	138	100	150	64	9.7 X 12.7	32
	4.25	5.43	3.94	5.91	2.52	.38 X .50	1.25
AMP114	114	134	100	170	73	9.7 X 12.7	32
	4.50	5.26	3.94	6.68	2.87	.38 X .50	1.25
AMP126	126	175	136	181	77	9.7 X 12.7	32
	4.96	6.89	5.35	7.12	3.03	.38 X .50	1.25
AMP146	146	168	136	197	89	9.7 X 12.7	32
	5.75	6.63	5.35	7.75	3.50	.38 X .50	1.25
AMP172	172	191	153	229	100	9.7 X 12.7	32
	6.75	7.50	6.02	9.00	3.94	.38 X .50	1.25
AMP206	206	254	208	248	115	9.7 X 12.7	32
	8.11	10.00	8.20	9.75	4.53	.38 X .50	1.25
AMP231	231	254	208	274	125	9.7 X 12.7	32
	9.10	10.00	8.20	10.80	4.93	.38 X .50	1.25

STAUFF Clamp Part Number	Dimensions (mm/in)							
	"øD" Nom	A	B	C	H	K	L	Width
AMP/D206	206	260	208	230	118	275	15.0	38
	8.11	10.24	8.19	9.06	4.65	10.83	0.59	1.50
AMP/D210	213	270	216	238	123	285	15.0	38
	8.39	10.63	8.50	9.37	4.84	11.22	0.59	1.50
AMP/D219	219	268	216	242	123	285	15.0	38
	8.63	10.55	8.50	9.53	4.84	11.22	0.59	1.50
AMP/D228	232	254	216	251	126	317	15.0	38
	9.12	10	8.50	9.89	4.95	12.48	0.59	1.50
AMP/D254	248	264	216	267	135	330	15.0	38
	9.75	10.40	8.50	10.50	5.31	13.00	0.59	1.50
AMP/D286	286	332	280	315	163	355	15.0	38
	11.26	13.07	11.02	12.40	6.42	13.98	0.59	1.50
AMP/D310	310	332	280	334	170	380	15.0	38
	12.20	13.07	11.02	13.15	6.69	14.96	0.59	1.50
AMP/D362	359	427	365	383	195	424	15.0	38
	14.13	16.80	14.35	15.08	7.68	16.70	0.59	1.50

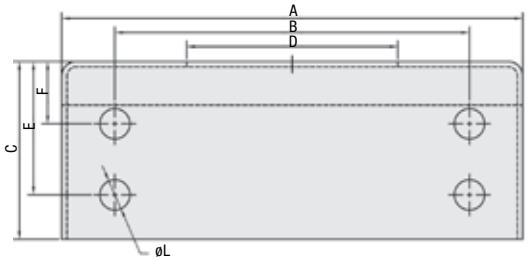
Type BB & RR Series

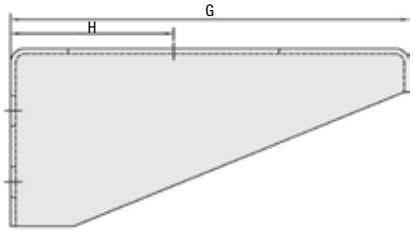
Specifications

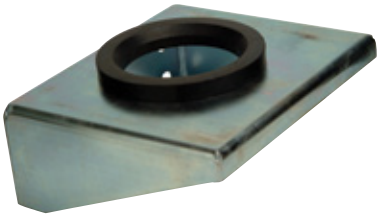
- Rubber Bushing to reduce vibration and noise
- Compensation for thermal expansion and contraction
- Galvanized to resist corrosion
- Special sizes and designs are available upon request

Base Bracket with Rubber Ring

(to specify base bracket less rubber ring remove “R” from model number)

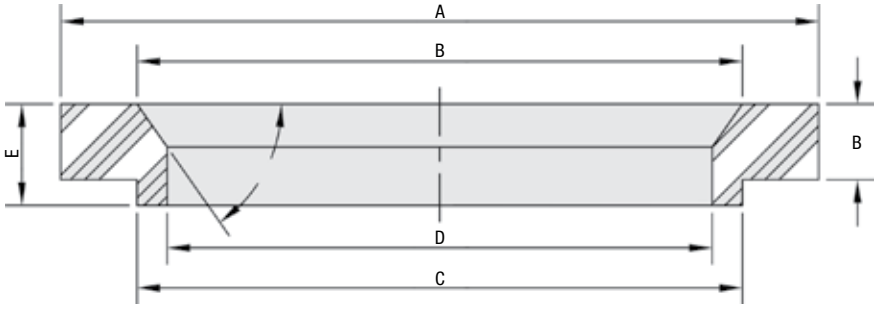






Model	Dimensions (mm/in)									Weight (kg/lbs)
	A	B	C	D	E	F	G	H	L	
BB120R	260	200	100	120	75	35	225	100	17	2.3
	10.24	7.87	3.94	4.72	2.95	1.38	8.86	3.94	.67	5.1
BB170R	260	200	100	170	75	35	225	123	17	2.0
	10.24	7.87	3.94	6.69	2.95	1.38	8.86	4.84	.67	4.5
BB211R	390	270	240	211	7.09	60	390	195	22	7.7
	15.35	10.63	9.45	8.31	60	2.36	15.35	7.68	.87	16.9

Rubber Ring Only



Model	Dimensions (mm/in)						Use with Base Bracket No.
	A	B	C	D	E	F	
RR108	150	120	119	108	20	15	BB-120
	5.91	4.72	4.69	4.25	0.79	0.59	
RR160	200	170	169	159	20	15	BB-170
	7.87	6.69	6.65	6.26	0.79	0.59	
RR200	250	220	210	200	25	20	BB-211
	9.84	8.66	8.27	7.87	0.98	0.79	

Mounting Brackets Compatibility Information for Bladder Accumulators

For 3000 PSI Bladder Accumulators				
Bladder Accumulator Size	**Clamp Number**	**Qty.**	**Nominal Diameter (mm/in)**	**Base Bracket**
1 Quart	AMP114	1	114 4.50	None
1 Gallon	AMP172	1	171 6.75	BB120R
2.5 Gallon	AMP/D228	1	231 9.10	BB170R
5 Gallon	AMP/D228	2	231 9.10	BB170R
10 Gallon	AMP/D228	2	231 9.10	BB170R
11 Gallon	AMP/D228	2	231 9.10	BB170R
15 Gallon	AMP/D228	3	231 9.10	BB170R

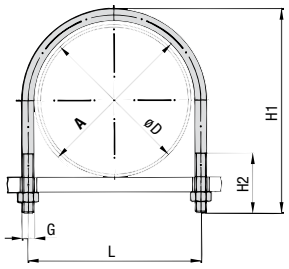
For 5000 PSI Bladder Accumulators				
Bladder Accumulator Size	**Clamp Number**	**Qty.**	**Nominal Diameter (mm/in)**	**Base Bracket**
1 Quart	AMP126	1	126 4.96	None
1 Gallon	AMP172	1	180 7.00	BB120R
2.5 Gallon	AMP/D254	1	248 9.75	BB170R
5 Gallon	AMP/D254	2	248 9.75	BB170R
10 Gallon	AMP/D254	2	248 9.75	BB170R
15 Gallon	AMP/D254	3	248 9.75	BB170R

Mounting Brackets Compatibility Information for Piston Accumulators

Piston Accumulator Size	**Clamp Number**	**Qty.**	**Diameter (mm/in)**	**Base Bracket**
1 Quart	AMP114	1	114 4.50	None
2 Quart	AMP114	1	114 4.50	None
1 Gallon	AMP114	1	114 4.50	None
	AMP146	2	140 5.5	None
	AMP172	1	178 7.0	BB120R
1.5 Gallon	AMP114	2	114 4.50	None
	AMP146	2	140 5.5	None
	AMP172	1	178 7.0	BB120R
2 Gallon	AMP114	1	114 4.50	None
2.5 Gallon	AMP146	2	140 5.5	None
	AMP172	1	178 7.0	BB120R
	AMP/D206	1	203 8.0	BB170R
3 Gallon	AMP146	2	140 5.5	None
	AMP172	1	178 7.0	BB120R
	AMP/D206	1	203 8.0	BB170R
4 Gallon	AMP146	2	140 5.5	None
	AMP172	1	178 7.0	BB120R
	AMP/D206	1	203 8.0	BB170R

Bladder Accumulator Size	**Clamp Number**	**Qty.**	**Diameter (mm/in)**	**Base Bracket**
5 Gallon	AMP146	3	140 5.5	None
	AMP172	2	178 7.0	BB170R
	AMP/D206	1	203 8.0	BB170R
	AMP/D228	1	228 9.0	BB170R
7.5 Gallon	AMP/D206	2	203 8.0	BB170R
	AMP/D228	1	228 9.0	BB170R
10 Gallon	AMP/D206	2	203 8.0	BB170R
	AMP/D228	2	228 9.0	BB170R
15 Gallon	AMP/D206	2	203 8.0	BB170R
	AMP/D228	2	228 9.0	BB170R
17.5 Gallon	AMP/D228	2	228 9.0	BB170R
20 Gallon	AMP/D206	3	203 8.0	BB170R
	AMP/D228	3	228 9.0	BB170R
23 Gallon	AMP/D228	3	228 9.0	BB170R
25 Gallon	AMP/D228	3	228 9.0	BB170R

Round Steel U-Bolt Clamps
Type RBD



Order Codes

Clamp Assembly ***RBD*W1*A 30**

One clamp assembly is consisting of one Round Steel U-Bolt (type RBD) and two Nuts (to DIN EN ISO 4032).

* Clamp Assembly (as listed above)		**RBD**
* Material code	Carbon Steel, untreated	**W1**
	Carbon Steel, zinc-plated and thick-film passivated	**W66**
* Dimension A (mm)		**A 30**

Please note: All items are supplied non-assembled.

Round Steel U-Bolt (type RBD)

Diameter Nominal	Outside Diameter Pipe / Tube Ø D1		Nominal Bore Pipe	Dimensions (mm/in) Round Steel U-Bolt (Type RBD)				
DN	(mm)	(in)	(in)	A	L	H1	H2	Thread G
20	**25**	.98		**30**	40	70	40	M10
					1.57	2.76	1.57	
	26,9	1.06	3/4	1.18	40	70	40	M10
					1.57	2.76	1.57	
25	**30**	1.18		**38**	48	76	40	M10
					1.89	2.99	1.57	
	33,7	1.33	1	1.50	48	76	40	M10
					1,89	2.99	1.57	
32	**38**	1.50		**46**	56	86	50	M10
					2.20	3.39	1.97	
	42,4	1.69	1-1/4	1.81	56	86	50	M10
					2.20	3.39	1.97	
40	**44,5**	1.76		**52**	62	92	50	M10
					2.44	3.62	1.97	
	48,3	1.90	1-1/2	2.05	62	92	50	M10
					2.44	3.62	1.97	
50	**57**	2.28		**64**	76	109	50	M12
					2.99	4.29	1.97	
	60,3	2.41	2	2.52	76	109	50	M12
					2.99	4.29	1.97	
65	**76,1**	3.04	2-1/2	**82**	94	125	50	M12
				3.23	3.70	4.92	1.97	
80	**88,9**	3.56	3	**94**	106	138	50	M12
				3.70	4.17	5.43	1.97	
100	**108**	4.32		**120**	136	171	60	M12
					5.35	6.73	2.36	
	114,3	4.57	4	4.72	136	171	60	M16
					5.35	6.73	2.36	
125	**133**	5.32		**148**	164	191	60	M16
					6.46	7.52	2.36	
	139,7	5.59	5	5.83	164	191	60	M16
					6.46	7.52	2.36	
150	**159**	6.36		**176**	192	217	60	M16
					7.56	8.54	2.36	
	168,3	6.73	6	6.93	192	217	60	M16
					7.56	8.54	2.36	
175	**193,7**	7.75		**202**	218	249	60	M16
				7.96	8.58	9.80	2.36	
200	**216**	8.64		**228**	248	283	70	M20
					9.76	11.14	2.76	
	219,1	8.76	8	8.98	248	283	70	M20
					9.76	11.14	2.76	
250	**267**	10.68		**282**	303	334	70	M20
					11.93	13.15	2.76	
	273	10.92	10	11.10	302	334	70	M20
					11.89	13.15	2.76	
300	**318**	12.72		**332**	352	385	70	M20
					13.86	15.16	2.76	
	323,9	12.96	12	13.07	352	385	70	M20
					13.86	15.16	2.76	
350	**355,6**	14.22	14	**378**	402	435	70	M24
					15.83	17.13	2.76	
	368	14.72		14.88	402	435	70	M24
					15.83	17.13	2.76	
400	**406,4**	16.26	16	**428**	452	487	70	M24
					17.80	19.17	2.76	
	419	16.76		16.85	452	487	70	M24
					17.80	19.17	2.76	
500	**508**	20.32	20	**530**	554	589	70	M24
					21.81	23.19	2.76	
	521	20.84		20.87	554	589	70	M24
					21.81	23.19	2.76	

Operating and Maintenance Instructions

Installation

- The accumulator in a hydraulic circuit should be placed as near as practical to the source of shock or potential energy requirement.
- All accumulators will be shipped from the factory with a nominal pre-charge pressure. This is done to seat the accumulator poppet valve on the hydraulic port and too keep the accumulator bladder inflated at all times.
- Keep the accumulator hydraulic port covered until you are ready to make the hydraulic connection. This is done to keep out any foreign or contaminating material from the accumulator.
- Normally an accumulator should be installed in a vertical position with the oil port connection facing down. If required, it may be installed no more than within 25° of vertical with the hydraulic port facing downward. Bladder type accumulators not mounted vertical have an increased risk of the bladder floating, which traps usable fluid inside. The bladder can be pinched by the poppet valve closing, which may rupture the bladder. A non-vertical accumulator position requires more care when draining the fluid from the accumulator.
- When installing an accumulator and using “U” bolt type clamps, care should be exercised so as not to distort the accumulator with excessive force.
- Welding hangers to the accumulator is not recommended. Mounting brackets, bases and rubber rings are available from STAUFF, (See accumulator accessories pages 16-18).
- The hydraulic fluid used must be kept free of foreign matter to prevent damaging the accumulator. For maximum seal and accumulator life, the fluid should be filtered to 10 microns or better.
- It is not advisable to change the hydraulic fluid from that for which the accumulator was originally purchased for, without first checking its compatibility with the accumulator seals and bladder materials.

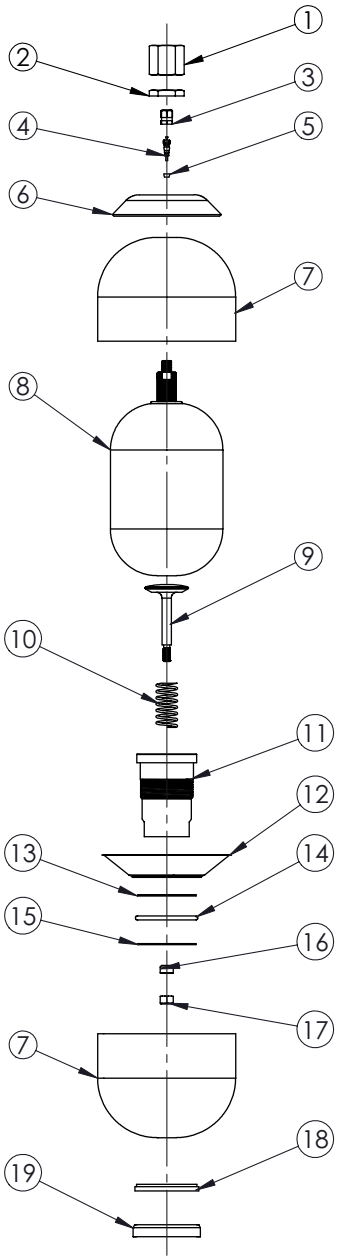
Pre-Charging Procedure
General Information

- The condition of the accumulator is primarily determined by periodically checking the pre-charge pressure.
- Hydraulic accumulators are pressure vessels and only qualified personnel should perform any maintenance.
- Drain all fluid completely from accumulator before performing any maintenance.
- The most accurate pre-charge readings can only be taken when the fluid pressure is at “0 psig”.
- Always observe the maximum working pressure and operating temperature ranges of the accumulator.
- **CAUTION - DO NOT** weld, braze or machine directly on the accumulator shell.
- **CAUTION - DO NOT** use automotive type valve cores with high pressure accumulator gas valves.
- **CAUTION - DO NOT** use the gas valve or the fluid port assembly as lifting points.
- **CAUTION - DO NOT** use oxygen or air for precharging the accumulator due to risk of explosion, USE only dry 99.99% pure nitrogen for charging accumulators.

DO NOT USE OXYGEN FOR PRE-CHARGING THE ACCUMULATOR!

Parts Breakdown

3000 PSI Bottom Repairable, 1 Qt.



Item	Description
1	Protective Cap
2	Bladder Nut
3	Gas Valve Cap
4	Gas Valve Core
5	Gas Valve Core Seal
6	Name Plate
7	Shell
8	Bladder
9	Poppet Valve
10	Poppet Spring
11	Oil Port
12	Anti Extrusion Ring
13	Metal Back up Ring
14	O-Ring
15	Back up Ring
16	Poppet Piston
17	Poppet Lock Nut
18	Flange Washer
19	Locking Ring

Please see page 10 for replacement bladder kit part numbers.

Replacement bladder kits includes items: 3, 4, 5, 8, 12, 13, 14

Replacement Gas valveCore

Replacement gas valve for the 3000 PSI 1 Qt accumulators

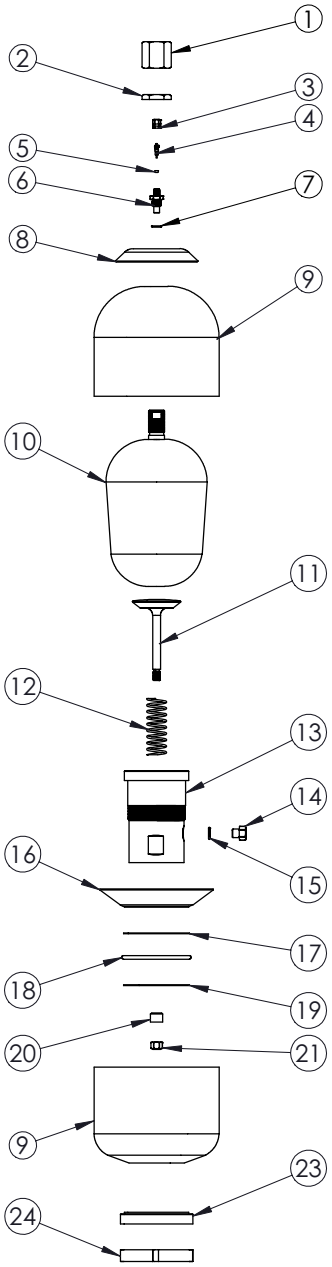
Gas Valve Core part Number
STDA-X-VC

Includes items:
3, 4, 5

Note: The complete gas valve assembly is included with STAUFF replacement bladder kits

Parts Breakdown

3000 PSI Bottom Repairable, 1 to 15 Gallon, Standard and High Flow

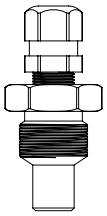


Item	Description
1	Protective Cap
2	Bladder Nut
3	Gas Valve Cap
4	Gas Valve Core
5	Gas Valve Core Seal
6	Gas Valve Body
7	Gas Valve O-Ring
8	Name Plate
9	Shell
10	Bladder
11	Poppet Valve
12	Poppet Spring
13	Oil Port
14	Bleed Plug
15	Bleed Plug Seal
16	Anti Extrusion Ring
17	Metal Back up Ring
18	O-Ring
19	Back up Ring
20	Poppet Piston
21	Poppet Lock Nut
22	Flange Washer
23	Locking Ring

Please see page 10 for replacement bladder kit part numbers.

Replacement bladder kits includes items: 3, 4, 5, 6, 7, 10, 17, 1, 19

Replacement Gas Valve Core



Replacement gas valve for the 3000 PSI accumulators 1 gallon to 15 Gallon

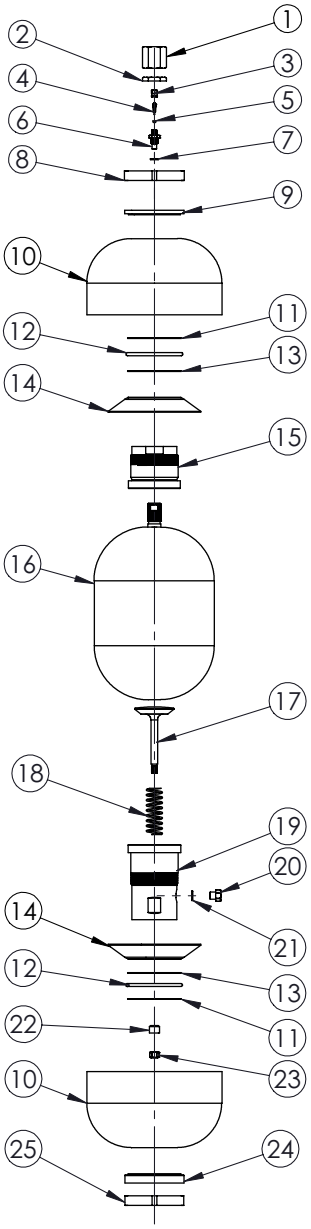
Cored Valve Cartridge Part Number STA-AS-GV-1-15-P3

Includes items:
3, 4, 5, 6, 7

Note: The complete gas valve assembly is included with STAUFF replacement bladder kits

Parts Breakdown

3000 PSI Top Repairable, 2.5 to 15 Gallon

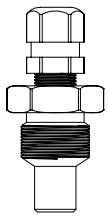


Item	Description
1	Protective Cap
2	Bladder Nut
3	Gas Valve Cap
4	Gas Valve Core
5	Gas Valve Core Seal
6	Gas Valve Body
7	Gas Valve O-Ring
8	Top Locking Ring
9	Top Flange Washer
10	Shell
11	Back up Ring
12	O-Ring
13	Metal Back up Ring
14	Anti Extrusion Ring
15	Top Adapter
16	Bladder
17	Poppet Valve
18	Poppet Spring
19	Oil Port
20	Bleed Plug
21	Bleed Plug Seal
22	Poppet Piston
23	Poppet Lock Nut
24	Flange Washer
25	Locking Ring

Please see page 10 for replacement bladder kit part numbers.

Replacement bladder kits includes items (1 ea.): 3, 4, 5, 6, 7, 11, 12, 13, 16

Replacement Gas Valve



Replacement gas valve for the 3000 PSI accumulators 1 gallon to 15 Gallon

Cored Valve Cartridge Part Number STA-AS-GV-1-15-P3

Includes items:
3, 4, 5, 6, 7

Note: The complete gas valve assembly is included with STAUFF replacement bladder kits

Pre-Charging

3000 PSI Bladder Accumulators

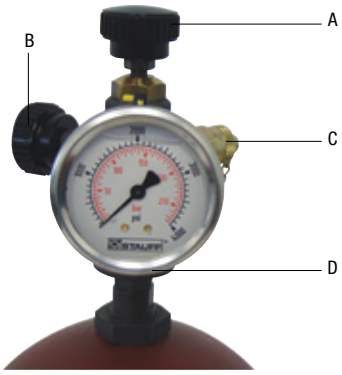


Figure 1.

Figure 2.

1. Isolate the accumulator from the system and make sure hydraulic fluid pressure is zero.

2. Remove the gas valve protection guard and then the gas valve cap from the accumulator **(for top repairable accumulators connect a gas valve extension unit similar to Stauff Part # STA-VLV-EXT-1 at this time).**

3. To charge the accumulator, use a charging hose and gauge assembly similar to Stauff Charging Kit # STBA-CK-B/T-P3 rated for 3,000 psig minimum (higher pressure kits are available).

4. Before using the charging assembly (Figure 1.) make sure that valve **A** is completely open (counter-clockwise), ensure that bleed valve **B** (Figure 1.) is completely closed (clockwise) and that the non-return valve **C** (Figure 1.) is capped.

5. Connect the charging unit to the gas fill valve or gas valve extension unit (for top repairable) on the accumulator by means of knurled cap **D** (Figure 1.).

6. Make sure the valve on the nitrogen bottle is completely closed, then fit the nitrogen gas valve adapter/hose assembly (included in Stauff charging kit # STBA-CK-B/T-P3) onto the nitrogen bottle (Figure 2.).

7. Connect the other end of gas hose to the non-return valve **C** (Figure 1.), after taking off the cap.

8. Turn valve **A** (Figure 1.) clockwise until it stops **(Do not over Torque)**.

9. **SLOWLY** open the valve on nitrogen bottle (Figure 2.) and allow the nitrogen gas to flow into the accumulator. The pressure gauge should begin to register pressure.

10. Once the desired gas pre-charge pressure has been reached, close valve on nitrogen bottle (Figure 2.). The pressure should be slightly higher than the desired pre-charge pressure.

11. Open valve **A** (Figure 1.) (Fully counter-clockwise) to bleed the trapped pressure in the gas line to zero by means of bleed valve **B** (Figure 1.), open valve **B** (turn counterclockwise) until gauge reads 0 psig.

12. Remove hose from non-return valve **C** (Figure 1.) and replace cap.

13. Close the bleed valve **B** (Figure 1.) and wait a few minutes for pressure to stabilize.

14. Screw valve **A** (Figure 1.) clockwise until pressure can be read on gauge. This should be slightly higher than the required pressure.

15. Adjust to desired pressure by means of bleed valve **B** (Figure 1.), then remove charging unit from the accumulator gas valve and from the nitrogen bottle (after making sure that the nitrogen bottle valve is completely closed.

16. If necessary remove the gas valve extension unit (top repairable accumulators only), then reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

NOTE: Allow the accumulator to rest approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safely glasses.

Checking Pre-Charge Pressure

3000 PSI Bladder Accumulators

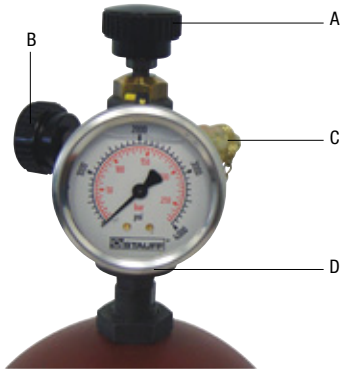


Figure 1.

General Information

The condition of the accumulator is primarily determined by periodic checking of pre-charge pressure. Only qualified personnel should perform any maintenance on accumulators. Nitrogen gas pre-charge pressure should be checked at least once during the first week of operation to assure that no leak has developed. The pre-charge pressure and ambient temperature should be recorded at installation. If there is no loss of gas pre-charge pressure, it should be rechecked in approximately 4 months. Thereafter, it should be checked annually. Check pre-charge if the system is acting sluggishly. If pre-charge is low, check the gas valve for leakage and recharge.

Pre-Charge Checking Procedure for 3000 PSI Bladder Accumulators.

1. Use appropriate valving in the hydraulic system, to discharge all hydraulic fluid from accumulator.

2. To check or adjust pre-charge pressure, **HYDRAULIC PRESSURE MUST BE REDUCTED TO 0 PSIG**. Pre-charge pressure should be checked periodically. Charging and checking should be done with an accumulator charge assembly kit similar to Stauff Part # STBA-CK-B/T-P3.

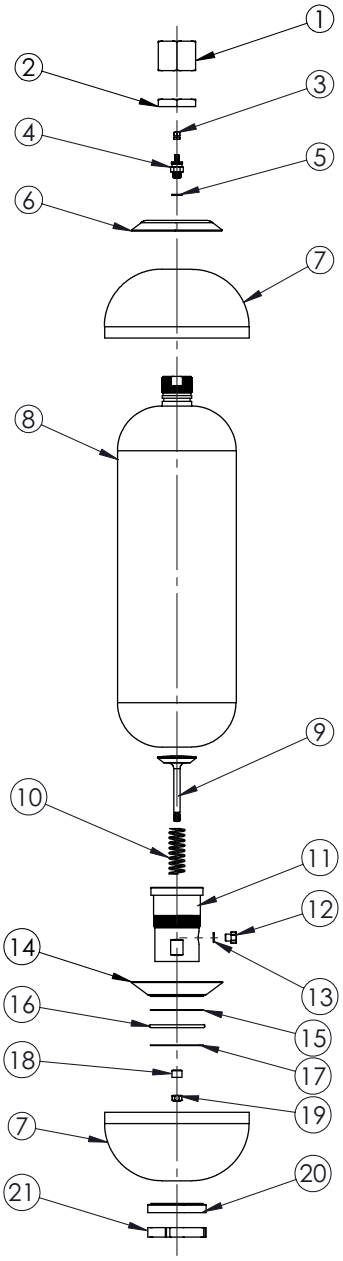
3. Follow pre-charging instructions for 3000 psi bladder accumulators - instructions #4 through #15.

4. If necessary remove the gas valve extension unit (top repairable accumulators only), then reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

NOTE: Allow the accumulator to rest approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safely glasses.

Parts Breakdown

5000 PSI Bottom Repairable, 2.5 to 15 Gallon

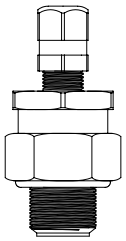


Item	Description
1	Protective Cap
2	Bladder Nut
3	Gas Valve Cap
4	Gas Valve
5	Gas Valve O-Ring
6	Name Plate
7	Shell
8	Bladder
9	Poppet Valve
10	Poppet Spring
11	Oil Port
12	Bleed Plug
13	Bleed Plug Seal
14	Anti Extrusion Ring
15	Metal Back up Ring
16	O-Ring
17	Back up Ring
18	Poppet Piston
19	Poppet Lock Nut
20	Flange Washer
21	Locking Ring

Please see page 10 for replacement bladder kit part numbers.

Replacement bladder kits includes items: 3, 4, 5, 8, 15, 16, 17

Replacement Gas Valve Core



Replacement gas valve for the 5000 PSI accumulators 2.5 gallon to 15 Gallon

Cored Valve Cartridge Part Number STA-AS-GV-1-15-P5

Includes items:
3, 4, 5

Note: The complete gas valve assembly is included with STAUFF replacement bladder kits

Pre-Charging

5000 PSI Bottom Repairable Bladder Accumulators

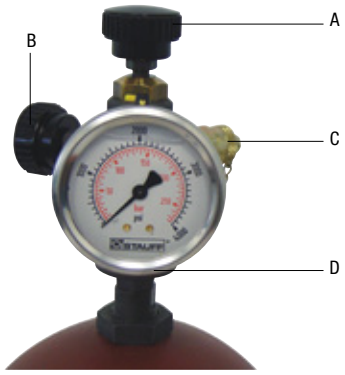


Figure 1.

Figure 2.

Pre-Charging Procedure for 5000 PSI Bottom Repairable Bladder Accumulators.

1. Isolate the accumulator from the system and make sure hydraulic fluid pressure is zero.

2. Remove the gas valve protection guard and then the gas valve cap from the accumulator.

3. To charge the accumulator, use a charging hose and gauge assembly similar to Stauff Charging Kit # STBA-CK-B-P5, rated for 5,000 psig minimum.

4. Before using the charging assembly (Figure 1.) make sure that valve **A** is completely open (counter-clockwise), that bleed valve **B** (Figure 1.) is completely closed (clockwise) and that the non-return valve **C** (Figure 1.) is capped.

5. Connect the charging unit to the 5000 psi gas fill valve on the accumulator by means of knurled cap **D** (Figure 1.).

6. Open the gas valve adapter on the accumulator (referring to the 5000 PSI gas valve STA-AS-GV-1-15-P5) by securing the bottom hex on the gas valve with one (1) wrench while unscrewing the top hex on the gas valve (counter clockwise) with a second (2) wrench. This will open the poppet inside the gas valve. Note, four (4) turns should fully open the poppet.

7. Make sure the valve on the nitrogen bottle is completely closed, then fit the 5000 PSI nitrogen gas valve adapter/hose assembly (included in Stauff Charging Kit # STBA-CK-B-P5) onto the nitrogen bottle (Figure 2.).

8. Connect the other end of the gas hose to the non-return valve **C** (Figure 1.), after taking off its cap.

9. Turn valve **A** (Figure 1.) clockwise until it stops **(Do not over Torque).**

10. **SLOWLY** open the valve on nitrogen bottle (Figure 2.) and allow the nitrogen gas to flow to the accumulator. The pressure gauge should begin to register pressure.

11. Once the desired gas pre-charge pressure has been reached, close valve on nitrogen bottle (Figure 2.).

12. Open valve **A** (Figure 1.) (Fully counter-clockwise) and bleed the trapped pressure in the gas line to zero by means of bleed valve **B** (Figure 1.), open valve **B** (turn counterclockwise) until gauge reads 0 psig.

13. Remove hose from non-return valve **C** (Figure 1.) and replace cap.

14. Close the bleed valve **B** (Figure 1.) and wait a few minutes for pressure to stabilize.

15. Screw valve **A** (Figure 1.) clockwise until pressure can be read on gauge. This should be slightly higher than the required pressure.

16. Adjust to desired pressure by means of bleed valve **B** (Figure 1.), then, with a wrench screw in the top hex on the accumulator gas valve until tight, then remove charging unit from the accumulator gas valve and from the nitrogen bottle (after making sure that the nitrogen bottle valve is completely closed.

17. Reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

NOTE: Allow the accumulator to rest approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safely glasses.

Checking Pre-Charge Pressure

5000 PSI Bladder Accumulators

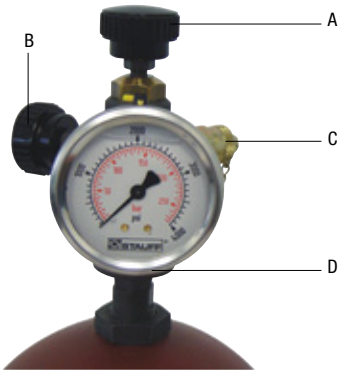


Figure 1.

General Information

The condition of the accumulator is primarily determined by periodic checking of pre-charge pressure. Only qualified personnel should perform any maintenance on accumulators. Nitrogen gas pre-charge pressure should be checked at least once during the first week of operation to assure that no leak has developed. The pre-charge pressure and ambient temperature should be recorded at installation. If there is no loss of gas pre-charge pressure, it should be rechecked in approximately 4 months. Thereafter, it should be checked annually. Check pre-charge if the system is acting sluggishly. If pre-charge is low, check the gas valve for leakage and recharge.

Pre-charge Checking Procedure for 5000 PSI Bladder Accumulators

1. Use appropriate valving in the hydraulic system, to discharge all hydraulic fluid from accumulator.

2. To check or adjust pre-charge pressure, HYDRAULIC PRESSURE MUST BE REDUCTED TO 0 PSIG. Pre-charge pressure should be checked periodically. Charging and checking should be done with an accumulator charge assembly kit similar to Stauff Part # STBA-CK-B-P5.

3. Follow pre-charging instructions for 5000 psi bottom repairable bladder accumulators - instructions #4 through #16.

4. Reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

NOTE: Allow the accumulator to rest approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safely glasses.

Disassembly Procedures for Bladder Accumulators

Bladder Accumulators are Pressure Vessels and are fundamentally hazardous because they store energy in the form of compressed Gas and pressurized Fluid . Only people who have had the appropriate training with regard to disassembly of Accumulators should attempt to dismantle an Accumulator.

Note: Prior to disassembly of the Accumulator please ensure the following are checked first.

A. The pre-charge pressure is released from the Accumulator and there is no gas pressure left in the Accumulator. Use an appropriate pre-charging head connected to the Gas Valve and check to see that the gauge reads zero pressure. Open up the bleed valve on the charging head and make sure no gas can be heard coming from the Accumulator. (See Stauff Pre-Charging Instructions Pgs. 20 - 28).

B. Check to make sure that the poppet valve located in the Fluid Port is fully in the open position. (see Figure 4a.)

Note - in cases where the poppet valve is still in the closed position and the stem is extended (out position), do not attempt to service the vessel and contact the manufacturer.

C. Where possible check to make sure that any potential system fluid still in the Accumulator is not dangerous or can cause harm if it comes into contact with human skin, especially phosphate ester fluids. If necessary wear protective clothing.

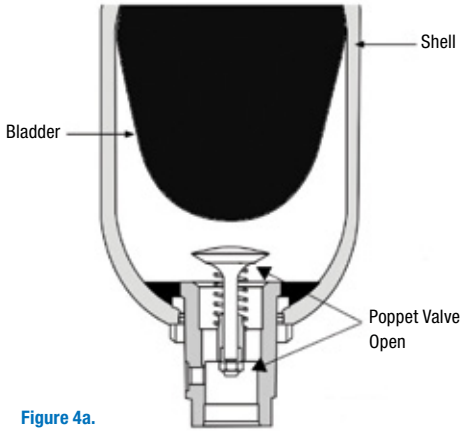


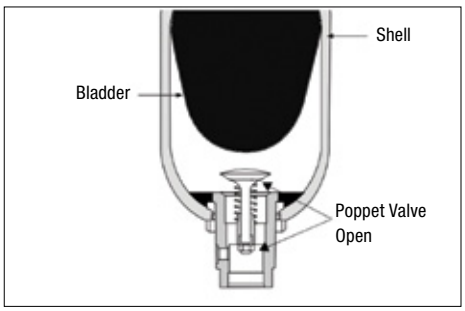
Figure 4a.

Disassembly Instructions

1. Remove the Protection Cap.

2. Remove the Gas Valve Assembly Cap.

3. Attach STAUFF pre-charging head and release any pre-charge from the Accumulator.

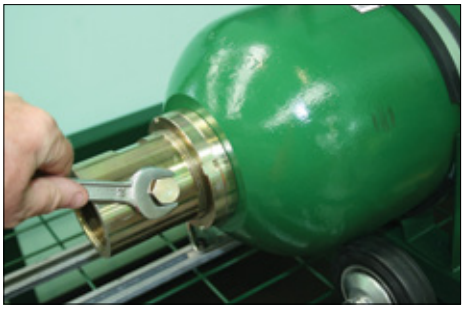


4. Ensure that the poppet valve is not closed. The stem should be fully in and free to move.

5. Remove the Gas Valve Assembly or Gas Valve Core.

6. Remove the Bladder Lock Nut and Name Plate.

Disassembly Intructions



7. Remove the Bleed Valve on the Fluid Port.

8. Remove the Fluid port Lock Nut with an appropriate “C” spanner along with the flanged washer.

9. Remove the Nylon Back-up Washer along with the O-Ring.

10a. Remove the Fluid Port Assy by first pushing the Fluid Port back into the inside of the shell.

10b. From inside the shell slide the Anti extrusion ring off the Fluid Port body and remove from the shell.

10c. The Fluid Port can then be removed from the shell.

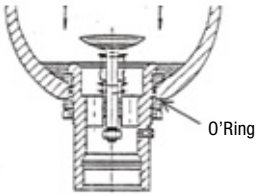
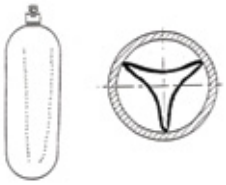
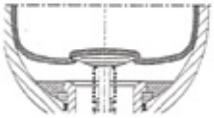
11. Remove as much air as possible from the Bladder, then remove the bladder from the Shell - do not use any sharp objects that could damage the bladder.

12. Inspect the Bladder.

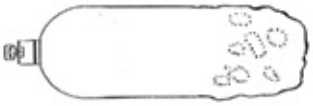
In cases where there are signs of damage, wear or swelling then the Bladder should be replaced.

Refer to page 31 and 32. outlining potential Damages, Causes and Response.

Trouble Shooting Guide

Type of Damage	Cause	Response	
External Leakage from Gas Valve			
Any leakage from the gas valve if not detected will eventually lead to bladder failure.	Any loss of Nitrogen from the gas valve will cause the compression ratio on the bladder to be exceeded and eventually cause the bladder to fail.	Always ensure that after pre-charging, or du-ring service intervals where the pre-charge is checked, that the gas valve is inspected for leaks.	
Severe leakage from the Gas Valve	Gas valve assembly or valve core damaged. In-correct charge valve used – gas valve has been tampered with.	Replace Gas Valve. Ensure the correct charging equipment is used.	
External Leakage from Fluid Port			
Leaking Oil between Fluid Port body and Accumulator Shell.	Damaged O-Ring caused during assembly or O-Ring has become hard due to High Oil temperatures.	Replace Fluid Port O-Ring. Check Assembly Methods Check oil system temperature.	
Internal Leakage from Bladder			
Upon pre-charge and less than 29 PSI (2 bar) the Bladder fails leaving a star shape burst pattern at the bottom of the Bladder.	The Accumulator was not lubricated properly and / or pre-charged too quickly. Excessive stretching of the bladder or the lower regionhas been caught in the poppet valve.	Replace Bladder. Ensure that the Shell and Bladder are well lubricated with system fluid. Pre-charge very slowly until the poppet valve is closed.	
Bladder has abrasion lines on 1, 2 or 3 sides. There is a failure along one of marked lines.	The compression ratio between Max. and Min. pressure is too high. The pre-charge pressure is too low or has not been checked for a long time. Gas permeation is an issue.	Replace Bladder. Ensure that the compression ratio is below 4:1 – Check pre-charge pressure more frequently. Replace with Bladder that has a higher acrolynitrile percentage.	
Bladder has failed at the bonded seam – Vulcanizing failure.	Bladder has rubbed on the inside of the shell due to the compression ratio too high. Manufacturing or Material fault.	Replace Bladder. Ensure that the compression ratio is below 4:1 Check pre-charge pressure more frequently.	
Bladder has Circular cut mark on the base.	Pre-charge pressure is too high.	Lower Pre-charge pressure.	
Bladder has a pin hole around the tip of the Bladder.	Loss of pre-charge pressure, leaking gas valve, the pre-charge pressure has not been checked.	Check / replace gas valve Check pre-charge more frequently.	

Trouble Shooting Guide

Type of Damage	Cause	Response	
Internal Leakage from Bladder			
Bladder has hardened and is carbonized.	Accumulator cycle time is very quick along with a very high compression ratio, causing high gas temperature. Oil temperature is too high..	Replace Bladder, Check Accumulator cycle time and reduce or increase size of Accumulator. Ensure oil temperature is lowered to the correct level.	
Bladder is swollen.	Incorrect bladder material. System fluid is not compatible with the bladder material.	Check compatibility of the bladder material with the fluid used. Consult Accumulator manufacturer.	
Anti- Extrusion Ring			
Anti-Extrusion Ring has split into two halves after disassembly.	Normal wear and tear.	Re-place Anti-Extrusion Ring.	
Fluid Port Assembly			
Worn Poppet Valve. Excessive side movement in the poppet valve or poppet valve is sticking when pushed down.	Normal Wear. Poppet valve is operated during each cycle. The pre-charge is too close or higher than the minimum working pressure. The flow rate from the accumulator is above the recommend flow rate for that model.	Replace Fluid Port Assy. Ensure pre-charge pressure is lowered to <90% of minimum working pressure. Decrease flow rate, use a larger Accumulator with bigger port. Increase the number of Accumulators used to reduce the output flow.	
Poppet Valve is broken. Very High Cycling application.	Poppet valve is operated during each cycle. The pre-charge is too close or higher than the minimum working pressure. The flow rate from the accumulator is above the recommend flow rate for that model.	Replace Fluid Port Assy. Ensure pre-charge pressure is lowered to <90% of minimum working pressure. Decrease flow rate, use a larger Accumulator with bigger port. Increase the number of Accumulators used to reduce the output flow.	

Assembly Procedures for Bladder Accumulators

Note: Prior to assembly of the Accumulator please ensure the following are checked first.

A. Always ensure that the Assembly is done in a clean area.

B. Make sure that the replacement Bladder is designed and sized for Accumulator being repaired.

C. Ensure that any system fluid still inside the Accumulator is not dangerous to the human skin. (Wear protective clothing if necessary).

D. Make sure there is no internal or external corrosion on the Accumulator or any evidence of damage to the shell prior to assembling the Accumulator.

E. It is the responsibility of the person doing the repair to ensure that the Accumulator complies with any relevant government requirements, such as Design and Inspection criteria.

If there is any doubt with regard to D. and E. above, the Accumulator should not be reassembled and preferably discarded.

Assembly Instructions

1. Ensure that the inside of the Shell is well lubricated with System Fluid.

Note: In some cases Standard Hydraulic Fluid may not be compatible with the System Fluid therefore an alternative fluid may need to be used.

2. Take Bladder and remove Gas Valve. Remove all air from the Bladder and fold neatly. Position Bladder inside Accumulator so that the Bladder Stem protrudes through the small opening at the other end of the Shell.

3. Fit Name Plate and Locknut to Bladder Stem.

4. Place Fluid Port inside the Shell Poppet Valve facing inwards.

5. Place Anti-Extrusion Ring inside the Shell and make sure the metal ring is facing you.

6. Slide the Anti-Extrusion Ring over the Fluid Port inside the Accumulator Shell.

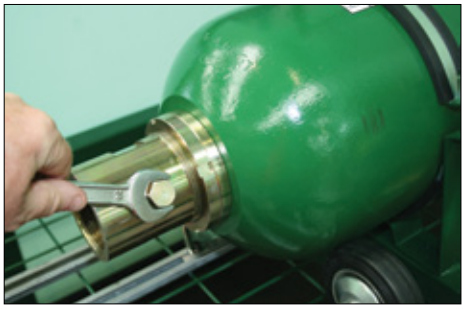
Assembly Intructions

7. Grip the Fluid Port Body from inside the Shell and pull out as far as possible.

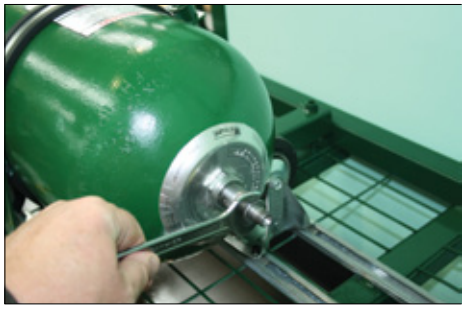
8. Holding the Fluid Port Body firmly install the O-Ring. Ensure no sharp tools are used and that the O-Ring is inserted evenly around the Fluid Port Body.

9. Ensuring the Fluid Port Body does not get dislodged - insert the Nylon Back-Up washer so that the rounded face on the washer faces the O-Ring.

10. Attach first the Flanged washer and then the Lock-Nut. Ensure the Lock-Nut is tightened using an appropriate spanner.



11. Fit the Bleed Plug or Test Point (if fitted) and tighten.



12. Fit the Gas Valve Assembly to the Bladder Stem and tighten to the correct setting. Ensure that when tightened the Bladder stem does not rotate.

13. Fit the Gas Valve Assembly Cap.

14. Fit the Gas Valve Protection Cap.

Note: With regard to pre-charging the Accumulator with Nitrogen, please refer to the STAUFF Pre-Charging Instructions.

Sizing Accumulators

Sizing Accumulators

In selecting the proper accumulator size V1 (size of accumulator in cubic inches) when Vw (volume of fluid to be discharged from accumulator) is known.

$$V1 = \frac{(Vw)(E)}{f}$$

E in the above equation adjusts the equation due to the accumulator efficiency versus the gas pre-charge pressure.
Use the following constants.

For Supplementing Pump
E = 1.24 for bladder accumulators.

For Auxiliary Power Source (No Pump)
E = 1.60 for bladder accumulators.

In the above equation the discharge coefficient “f” adjusts the equation for the change in the gas temperature due to heat gains and losses by expansion and compression of the gas (Calculate “f” as shown below).

Adiabatic Operation

In an adiabatic operation where the gas temperature is rapidly changing as a result of rapid compression and expansion of the gas:

$$f = 1 - \left(\frac{1}{a}\right)^{1/n}$$ (See Table 1, Page 36 for Calculations.)

Where:
$a = \frac{P_3}{P_2}$ = working pressure ratio
P_3 = Maximum system pressure
P_2 = Minimum system pressure
n = Polytropic exponent for adiabatic operation
(See Charts on Page 37)

Sizing Accumulators

In an isothermal operation where the compression and expansion of the gas is very slow, allowing enough time for heat transfer resulting in little or no change in gas temperature.

$$f = 1 - \left(\frac{1}{a}\right)$$

Where:
$a = \frac{P_3}{P_2}$ = working pressure ratio
P_3 = Maximum system pressure
P_2 = Minimum system pressure

Discharge Coefficient

$$f = 1 - \left(\frac{1}{a}\right)^{1/n}$$

Note: Use this formula if "a" is less than 1.1 or over 3.
If exact values of "a" are not shown, select the next higher value (See charts below).

How to Read Table 1

Locate "a" value in left-hand column and locate "n" value at top of Table 1. The point at which "n" and "a" intersect will be the "f" value.

Table 1

a Values	"n" Values											
	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95
1.0	0	0	0	0	0	0	0	0	0	0	0	0
1.1	.0658	.0636	.0616	.0596	. 0578	.0561	.0545	.0530	.0516	.0502	.0489	.0480
1.2	.1221	.1182	.1145	.1110	.1077	.1046	.1017	.0989	.0963	.0939	.0915	.0896
1.3	.1709	.1655	.1605	.1557	.1512	.1470	.1430	.1392	.1356	.1322	.1290	.1264
1.4	.2136	.2071	.2009	.1951	.1897	.1845	.1796	.1749	.1705	.1663	.1623	.1594
1.5	.2515	.2439	.2369	.2302	.2239	.2179	.2122	.2068	.2017	.1968	.1922	.1887
1.6	.2852	.2769	.2690	.2616	.2545	.2479	.2415	.2355	.2298	.2244	.2191	.2154
1.7	.3155	.3065	.2980	.2899	.2823	.2750	.2681	.2616	.2553	.2494	.2437	.2395
1.8	.3429	.3333	.3242	.3156	.3074	.2997	.2923	.2853	.2786	.2722	.2661	.2617
1.9	.3677	.3577	.3481	.3391	.3305	.3223	.3145	.3070	.2999	.2932	.2867	.2819
2.0	.3905	.3800	.3700	.3606	.3516	.3430	.3348	.3270	.3196	.3125	.3057	.3010
2.1	.4114	.4005	.3902	.3804	.3711	.3622	.3537	.3456	.3378	.3304	.3233	.3181
2.2	.4306	.4194	.4088	.3987	.3891	.3799	.3711	.3627	.3547	.3470	.3396	.3344
2.3	.4484	.4370	.4261	.4157	.4058	.3964	.3873	.3787	.3704	.3625	.3549	.3493
2.4	.4649	.4533	.442	.4315	.4214	.4117	.4025	.3936	.3851	.3770	.3692	.3634
2.5	.4803	.4684	.4571	.4463	.4360	.4261	.4167	.4076	.3989	.3906	.3820	.3766
2.6	.4947	.4826	.4711	.4601	.4496	.4396	.4300	.4207	.4119	.4034	.3952	.3891
2.7	.5081	.4959	.4843	.4731	.4625	.4523	.4425	.4331	.4241	.4154	.4071	.4010
2.8	.5207	.5084	.4966	.4854	.4746	.4642	.4543	.4448	.4356	.4268	.4184	.4120
2.9	.5326	.5226	.5083	.4969	.4860	.4755	.4654	.4558	.4465	.4376	.4290	.4226
3.0	.5438	.5337	.5193	.5078	.4967	,4862	.4760	.4662	.4568	.4478	.4391	.4326

Table 2

n	C3
1.41 - 1.45	.0300
1.46 - 1.49	.0318
1.50 - 1.53	.0336
1.54 - 1.57	.0352
1.58 - 1.62	.0371
1.63 - 1.67	.0389
1.68 - 1.73	.0410
1.74 - 1.79	.0429
1.80 - 1.85	.0447
1.86 - 1.91	.0464
1.92 - 1.94	.0472

Instructions for Selection of Discharge Coefficient “n”

1. Determine Average System Pressure

$$\frac{P2 + P3}{2} = \text{Average System Pressure}$$

2. Determine the time in seconds to discharge the oil from the accumulator.

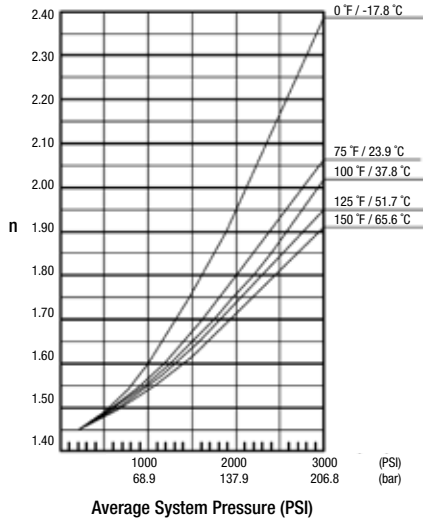
3. Select the graph which corresponds to the time (sec.) required to discharge the accumulator.

4. Select the curve on the graph which corresponds to the gas operating temperature (If gas temperature under operating conditions is not known assume 100 °F / 38°C.)

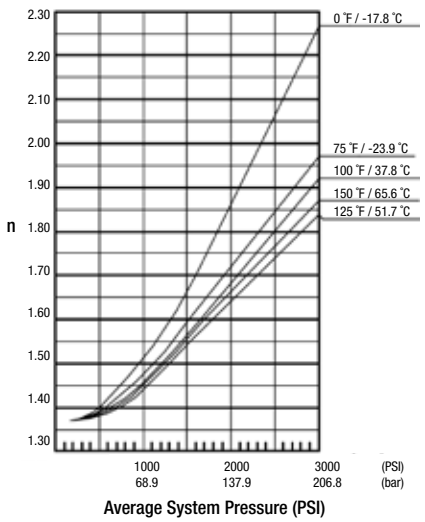
5. To use the graph, locate the average system pressure along the bottom portion of the graph. Move vertically along this column until you intersect the line corresponding to the gas temperature. Then move horizontally along this line and read the discharge coefficient to the left side of the graph.

Selection Charts for Discharge Coefficient “n”

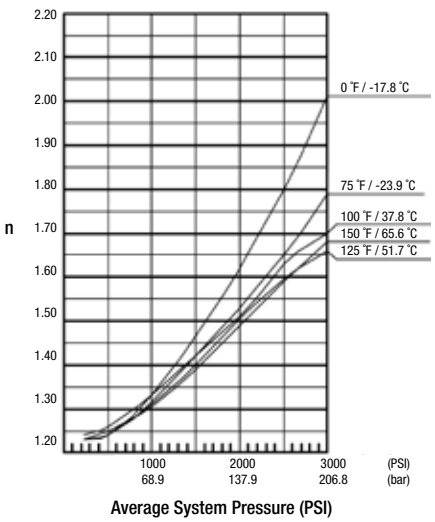
0 - 8 Seconds



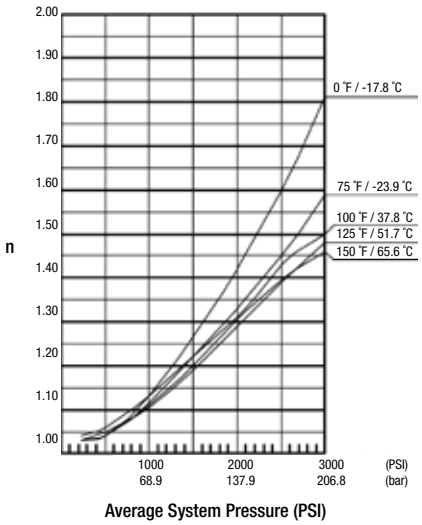
9 - 30 Seconds



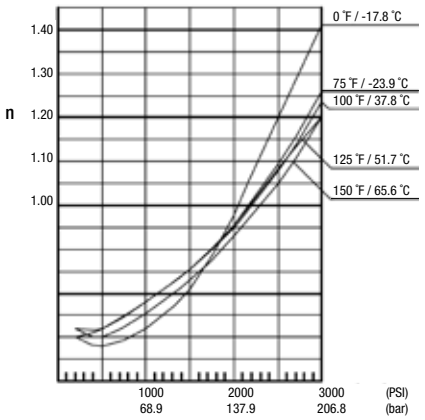
31- 60 Seconds



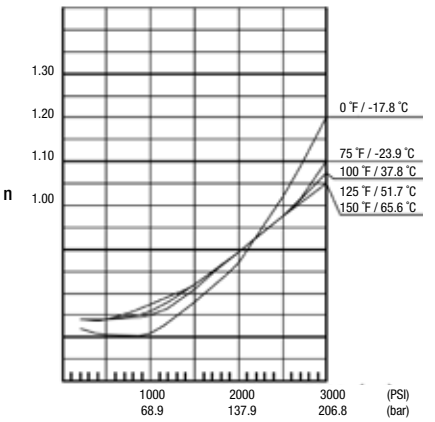
61 - 120 Seconds



121 - 500 Seconds



501 - 900 Seconds



Problem #1

Supplementing Pump Flow

Given: A 4.5" bore x 10" stroke cylinder with a 2" diameter rod must extend and retract in 6 seconds. Minimum pressure required to cycle cylinder is 1000 PSI (68 bar). Dwell time between cycles is 1.5 minutes. Gas temperature is 100 °F. Maximum system pressure is 2000 PSI (136 bar).

Information Required

P_2 = 1000 PSI (68 bar) = Minimum system pressure
P_3 = 2000 PSI (136 bar) = Maximum system pressure
CT = 6 sec. = Cycle time of actuator
VC = 286.5 in^3 = Displacement of actuator per cycle
DT = 90 sec. = Dwell time between cycles
T = 100 °F. = Gas operating temperature

Solve For:

PC = 3.0 in3/ sec. = $\frac{VC}{DT+CT}$ = minimum required output of pump (in^3/sec)
Q = .78 GPM = .26 PC = pump output (GPM)
Vw = 269 in^3 = VC – (3.85) (Q) (CT) = cubic inches of fluid required from accumulator
a = 2 = $\frac{P_3}{P_2}$ = working pressure ratio
n = 1.65 = From Page 37
f = .3430 = From Page 36 (Table 1) (Based on values of “a” & “n”)

Solution:

$V1\ (in^3) = \frac{(Vw)\ (E)}{f}$

E = 1.24 for bladder accumulator (See Page 35).

$V_1\ (in^3) = \frac{269\ (1.24)}{.3430} = 973\ in^3$ or 4.25 Gallons

Where V_1 = Accumulator size required in cubic inches

Once V_1 has been determined, select the accumulator from Pages 4-8 which has a gas volume equal to or greater then V_1. In this example a 5 gallon bladder accumulator would satisfy the system. P = gas pre-charge, which should be 80% of P_2 in bladder accumulators.

Problem #2

Increasing Actuation Speed in an Existing Hydraulic System

Given: Present system has a 5 GPM pump capable of 3000 PSI (207 bar), 6” bore x 12” stroke cylinder with a 2” rod. Minimum pressure to extend and retract cylinder is 1500 PSI (103 bar). Gas temperature is 150 °F. Bladder accumulator to be used. Cylinder cycle time is to be reduced from 40 seconds to 8 seconds. Dwell time between cycles is 40 seconds.

Information Required

P_2 = 1500 PSI (103 bar) = Minimum system pressure
P_3 = 3000 PSI (207 bar) = Maximum system pressure
CT = 8 sec. = Cycle time of actuator
VC = 640.5 in^3 = Displacement of actuator per cycle
DT = 40 sec. = Dwell time between cycles
Q = 5 GPM = Present pump flow
T = 150 °F. = Gas operating temperature

Solve For:

Vw = 486.5 in^3 = VC – (3.85) (Q) (CT)
VR = 770 in^3 = (3.85) (Q) (DT) is the pump output during the dwell period. VR must be Greater than Vw to accomplish the new cycle rate. If not, cycle time (CT) or dwell time (DT) must be increased.
a = 2 = $\frac{P_3}{P_2}$ = Pressure ratio
n = 1.76 = From Page 37
f = .3196 = From Page 36 (Table 1) (Based on values of “a” & “n”)

Solution:

$V_1\ (in^3) = \frac{(Vw)\ (E)}{f}$

E = 1.24 for bladder accumulator (See Page 35).

$V_1\ (in^3) = \frac{486.5\ (1.24)}{.3196} = 1887.5\ in^3$ or 8.2 Gallons

Where V_1 = Accumulator size required in cubic inches

Once V_1 has been determined, select the accumulator from Pages 4-8 which has a gas volume equal to or greater then V_1. In this example a 10 gallon bladder accumulator would satisfy the system. P = gas pre-charge, which should be 80% of P_2 in bladder accumulators.

Problem #3
Shock Suppression

Given: System has a 120 GPM pump operating at 2200 PSI (152 bar). Shock is caused by rapidly closing the directional control valve. 80 feet of pipe is between the pump and valve causing shock. Internal area of pipe is 1.4 square inches. Gas operating temperature is 100°F (38°C). Using standard petroleum oil (54.3 lbs/ft^3). What size of accumulator (V1) would be required to limit shock pressure to 10% above system pressure P2?

Information Required

L = 80 ft. = Length of pipe between pump and valve causing shock.
A = 1.4 in^2 = Internal area of pipe
P2 = 2200 PSI (152 bar) = Operating pressure
Q = 120 GPM = Rate of flow
T = 100 °F = Gas operating temperature

Solve For:

n = 1.80 = Discharge coefficient – See Page 37. Use 0-8 second curves.

VT = 0.78 ft^3 = $\frac{(L)\ (A)}{144}$ = Total volume of oil in pipe

WT = 54.3 lbs/ ft^3 = Weight of fluid per cubic foot

W = 42.2 lbs = (VT) (WT) = Total weight of liquid in pipe

V = 27.5 ft/ sec. = $\frac{(.3208)\ (Q)}{A}$ = Flow velocity

C3 = .0447 = From Page 36 (Table 2) (Opposite the “n” value selected)

Solution:

$V1\ (in^3) = \frac{(Vw)\ (E)}{f}$ = Size of accumulator required

$V_1 = \frac{(V)^2\ (W)\ (n\text{-}1)\ (.205)}{(P2)\ (C3)}$

$V_1\ \text{Gallons} = \frac{(27.5)2\ (42.2)\ (1.80\text{-}1)\ (.205)}{(2200)\ (.0447)} = 53.2\ in^3$ or .23

A_1 Qt. accumulator would satisfy the system.

P_1 gas pre-charge pressure should normally be 60% of P_2, (in a shock suppression application).

Guidelines for Selection, Installation and Operation

General
Hydraulic Diaphragm Accumulators from Stauff Corporation have been in use in numerous branches of industry for many years and are proven components. Optimal function and long service life are however only achieved if specific selection criteria are observed and incorrect installations and incorrect operating conditions are avoided.

For improved understanding of the following sections, the most important expressions and terms are briefly explained here.

Operating pressure
Normally the accumulator operates between P1 and P2

P0 = pre-charge pressure (normally 90% of P1)
P1 = minimum operating pressure
P2 = maximum operating pressure
P3 = system relieve pressure setting
P4 = maximum working pressure of accumulator
Pm= mean operating pressure

Permissible excess operating pressure P4
Max. pressure for which the accumulator is designed and that can be found in the technical documentation and the marking (rating plate, lettering).

Gas filling pressure
Before the diaphragm accumulator can be installed in a hydraulic system, it must be pre-charged with dry nitrogen gas. The pre-charge pressure is normally 95% to 90% of P1 at operating temperature.

Permissible pressure ratio
$P_2/P0$ or $P3/P0$ = pressure ratio < 8:1, 6:1, 4:1 depending on accumulator size. Figure stipulated by the manufacturer in relation to the compression ratio of the diaphragm accumulator, e.g. 8:1; this figure should not be exceeded (use pressure as absolute figures).

Aspects on the selection of a diaphragm accumulator
Selection in relation to the perm. excess operating pressure P4
The diaphragm accumulator is to be selected such that the permissible excess operating pressure P4, is in all circumstances above the upper operating pressure P2 to be expected and also above any pressure peaks that may occur.

Pressure peaks or pressure increase occur, e.g., due the switching of multiway valves and the resulting retardation of oil masses, retardation of fast moving masses, pressure translation in differential circuits, etc.

In this respect it is highlighted that pressure peaks may be so short that they can often not be measured with the aid of clamped measuring instruments such as pressure gauges. Safety valves also do not always react to such short pressure peaks.

Correct selection of the pre-charge pressure P0
The magnitude of the pre-charge pressure is dependent on the operating pressures to be expected and the type of application.

The following figures can be used as general guidance:

- with pulsation damping
  Po = 0.6 to 0.8 x Pm (Pm = mean operating pressure)

- with surge damping or volume storage
  Po = 0.6 to 0.9 x P1 (p1 = lower working pressure)

It is to be ensured that the pre-charge pressure does not exceed the value 0.9 x P1 also at the operating temperature. The pre-charge pressure established and specified at room temperature increases with increasing temperature in accordance with gas laws.

As a rule of thumb, a pressure increase of 10% for a 30 °C (86F) temperature increase can be expected.

If the pre-charge pressure is too low this may result in a drop in performance from the accumulator and result in high flexing loads on the diaphragm and shortened life of the diaphragm.

Gas Losses
Inadequate gas pressures can also be due to gas losses as a consequence of permeation processes. As elastic separating materials are not leak-proof in the absolute sense, gas molecules pass through the membrane, are dissolved in the operating fluid and transported to the reservoir where there can again separate from the fluid. The gas losses increase proportionally with the operating pressure and exponentially with the temperature. With conditions that are otherwise the same, gas losses will result in a faster reduction of the pre-charge on smaller hydraulic accumulators than on larger accumulators.

Estimates on possible gas losses can be determined on initial installations by monitoring the pre-charge on regular intervals. From this information it is possible to estimate maintenance intervals.

A pre-charge pressure that is too low from the start will be further reduced by gas pressure losses, and, under operating conditions that otherwise remain the same, a diaphragm accumulator will not be able to store the same volume of fluid. Diaphragms or bladders as separating components are overloaded resulting in a reduction in the service life. The damping capacity of the hydraulic accumulator will be reduced, and any pressure peaks that occur can exceed the permissible excess operating pressure. For this reason, the magnitudes of the pre-charge pressure losses are to be checked and increased at intervals to suit the application. The check can be performed very easily by using the pre-charge kit STDA-CK-M-1.

Correct Installation

Safety –related equipment
It is important that the maximum working pressure of the accumulator is not exceeded and that a safety pressure relieve device is installed in the system.

Fastening/Mounting
Accumulators must be securely fastened in order to prevent any vibration or stress on the accumulator fluid port. Special brackets and clamps are available.

Operating states to be avoided

Excessively high pressure ratio
An excessively high pressure ratio between the maximum operating pressure P2 and the pre-charge pressure P0 is to be avoided for various reasons. The max. permissible compression ratio and maximum pressure differential ΔP stated by the manufacturer takes into account a reasonable service life of diaphragms or bladders. If the ratio is exceeded, a significant reduction in the service life cannot be excluded. A further reason is that accumulator has a progressive characteristic curve, i.e. with increasing pressure the increase in the fluid volume stored per pressure unit becomes less and less. Expressed in a different way, the accumulator becomes “harder and harder”. In an application with volume storage, an increasing amount of (lost) energy must be expended to store less and less additional fluid.

Insufficient spacing of the pre-charge pressure P0 from the lower Operating pressure P1
If the pre-charge pressure (P0) is greater than the lower operating pressure (P1), the diaphragm accumulator empties itself completely during each operating cycle. Particularly on diaphragm accumulators, the sealing elements on the diaphragm sit on or hit the inside of the housing in the area of the fluid connection. Continuous contact can cause flash to form or cause other material deformations that can in turn destroy the diaphragm.

It is important to note that the pre-charge pressure can increase dramatically through an increase of temperature.

Briefly passing the pre-charge pressure during starting and shut down cannot be avoided for functional reasons, it is strongly recommended to consult the manufacturer, as special designs are available for difficult applications.

Sudden complete draining of a hydraulic accumulator
Applications in which a diaphragm accumulator can empty suddenly and without control are to be avoided. One of the possible disadvantages has already been described earlier. If the pre-charge pressure P0 is too close to the minimum operating pressure P1 then this can result in damage to the bottom of the diaphragm.

The result of a very high discharge rate from the accumulator may reduce the output stored volume due to a premature closure of the fluid port by the diaphragm.

Raised temperatures

The usual operating conditions for diaphragm accumulators is between -10°C and +80 °C. Higher temperatures are possible with separating components (bladders, diaphragms) made of special materials. However, here the progressively increasing gas losses with raised temperatures must be taken into account. In addition, a reduction in the permissible maximum working pressure is to be expected, as the strength figures for the housing material must be reduced.

Low temperatures

At temperatures below -10°C, the elasticity of the standard materials (NBR) for diaphragms and bladders reduces and there is a risk of fractures. If usage at such low temperatures cannot be avoided, special diaphragm materials must be used e.g. ECO. Please consult the manufacturer. It is also to be noted that not all housing materials are suitable or approved for low temperatures, as a drop in the notch impact strength can occur. In usage a differentiation is to be made between temperatures due to weather conditions and low temperatures of the medium stored.

Incompatible fluids

Hydraulic accumulators are designed as standard for use with mineral oil. If other fluids like water or even aggressive chemicals are to be used, special material combinations may be required. Please consult Stauff for questionable compatibility. Using a fluid that is not compatible with the housing or the diaphragm will result in damage.

Maintenance

Along with the external inspection for corrosion damage and correct mounting, the maintenance of a hydraulic accumulator is limited to the regular checking and correction, if necessary, of the pre-charge pressure. While for volume storage, variations in the gas filling pressure is mostly to be noticed in the form of inadequate function, for pulsation damping or surge damping, incorrect precharge pressure can remain undetected for long periods and cause damage to the accumulators or the system. Rule of thumb: Initially, check pre-charge pressure on monthly bases, then increase intervals, if no pressure loss is detected, to maintain proper pre-charge pressure.

To check, suitable charge devices should be used that are offered by the manufacturer for the various types of gas connections (M28 x 1.5 or Schrader ® valve). Suitable charge kits are also used to pre-charge the accumulator with dry Nitrogen.

If only the magnitude of the pre-charge pressure is to be determined, this task can also be performed on the fluid side, if it is possible to slowly fill or drain the hydro accumulator.

During slow filling, the filling process will be seen to slow down considerably when the gas filling pressure is reached. During discharge, the slow drop in pressure, a sudden pressure drop to zero occurs, which can be clearly seen on a pressure gauge. This process can be performed if necessary within a system without removing the accumulator.

Pre-charge the accumulator with zero pressure on the fluid port.

Installation

- The accumulator in a hydraulic circuit should be placed as near as practical to the source of shock or potential energy requirement.
- An installation space of 200mm (approximately 8 inches) should be maintained above the gas valve of the accumulator for any testing and charging devices that maybe required
- Normally an accumulator should be installed in a vertical position with the oil port connection facing downward (this is what Stauff recommends), however, a diaphragm accumulator may be mounted in any position without causing any harm to the accumulator, (horizontally or vertcally)
- All accumulators must be installed securely by using clamps and support brackets that are designed specifically for mounting the accumulator
- When installing an accumulator using “U” bolt type clamps, care should be exercised so as not to distort the accumulator with excessive force

Pre-Charging Procedure

General Information

- The condition of the accumulator is primarily determined by periodic checking of the pre-charge pressure.
- Hydraulic Accumulators are pressure vessels and only qualified personnel should perform maintenance.
- Drain all fluid completely from accumulator before performing any maintenance.
- DO NOT weld or braze directly on the accumulator shell.
- DO NOT use automotive type valve cores as high pressure accumulator gas valves.
- The most accurate pre-charge readings can only be taken when fluid pressure is at “0 PSI”.
- Always observe the maximum working pressure and operating temperature ranges.

Do not use oxygen for pre-charging the Accumulator!

Pre-Charging Diaphragm Accumulators with US Style Cored Gas Valve

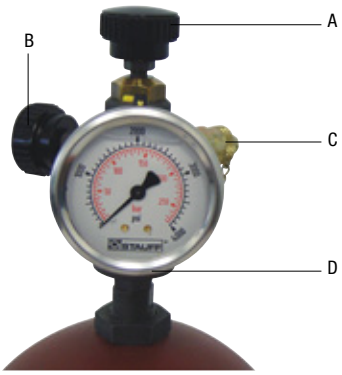


Figure 1.


Figure 2.

1. Isolate the accumulator from the system and make sure hydraulic fluid pressure is zero.

2. Remove the gas valve protection guard and then the gas valve cap from the accumulator.

3. To charge the accumulator, use a charging hose and gauge assembly similar to Stauff Charging Kit # STBA-CK-B/T-P3 rated for 3,000 psig minimum (higher pressure kits are available).

4. Before using the charging assembly (Figure 1.) make sure that valve **A** is completely open (counter-clockwise), ensure that bleed valve **B** (Figure 1.) is completely closed (clockwise) and that the non-return valve C (Figure 1.) is capped.

5. Connect the charging unit to the gas fill valve on the accumulator by means of knurled cap **D** (Figure 1.).

6. Make sure the valve on the nitrogen bottle is completely closed, then fit the nitrogen gas valve adapter/hose assembly (included in Stauff charging kit # STBA-CK-B/T-P3) onto the nitrogen bottle (Figure 2.)

7. Connect the other end of gas hose to the non-return valve **C** (Figure 1.), after taking off the cap.

8. Turn valve **A** (Figure 1.) clockwise until it stops **(Do not over Torque).**

9. **SLOWLY** open the valve on nitrogen bottle (Figure 2.) and allow the nitrogen gas to flow into the accumulator. The pressure gauge should begin to register pressure.

10. Once the desired gas pre-charge pressure has been reached, close valve on nitrogen bottle (Figure 2.).

11. Open valve **A** (Figure 1.) (Fully counter-clockwise) to bleed the trapped pressure in the gas line to zero by means of bleed valve **B** (Figure 1.), open valve **B** (turn counter-clockwise) until gauge reads 0 psig.

12. Remove hose from non-return valve C (Figure 1.) and replace cap.

13. Close the bleed valve B (Figure 1.) and wait a few minutes for pressure to stabilize.

14. Screw valve A (Figure 1.) clockwise until pressure can be read on gauge. This should be slightly higher than the required pressure.

15. Adjust to desired pressure by means of bleed valve B (Figure 1.), then remove charging unit from the accumulator gas valve and from the nitrogen bottle (after making sure that the nitrogen bottle valve is completely closed.

16. Reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

NOTE: Allow the accumulator to rest for approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safety glasses.

Pre-Charging Diaphragm Accumulators with Metric M28 x 1.5 Gas Valve

1. Isolate the accumulator from the system and make sure hydraulic fluid pressure is zero.

2. Remove gas valve protection cap and guard from the accumulator.

3. To charge the accumulator, use a charging and gauge kit similar to Stauff' Charging Kit # STDA-CK-M-1 rated for 3,700 psig minimum.

DANGER: DO NOT attempt to remove the accumulator gas valve screw with a hexagon wrench, as it could be ejected under very high pressure.

4. Before using the charging assembly (Figure 1.) make sure that hex valve **B** is completely closed (clockwise) and visually check that the engaging hex on the bottom of the assembly is fully extended. Ensure that bleed valve A (Figure 1.) is completely closed (clockwise) and that the non-return valve **C** (Figure 1.) is capped.

5. Connect the charging unit to the gas fill valve on the accumulator by means of knurled cap **D** (Figure 1.), connect by turning clockwise.

6. Make sure that the valve on the nitrogen bottle is completely closed, then fit the nitrogen gas valve adapter/hose assembly (included in Stauff Charging Kit # STBA-CK-B/T-P3) onto the nitrogen bottle (Figure 2.).

7. Connect the other end of gas hose to the non-return valve **C** (Figure 1.), after taking off its cap.

8. Turn valve **B** (Figure 1.) counter-clockwise a minimum of three complete turns, thereby opening the hex gas valve **(Do not over Torque).**

9. **SLOWLY** open valve on nitrogen bottle (Figure 2.) and allow the nitrogen gas to flow into the accumulator. The pressure gauge on the charging assembly will begin to register a pressure increase in the accumulator.

10. Once the desired gas pre-charge pressure has been reached, close the valve on nitrogen bottle (Figure 2.). The reading on the gauge should be slightly higher than the required pressure.

11. Adjust to desired pre-charge pressure by means of bleed valve **A** (Figure 1.) turn counter-clockwise and slowly bleed nitrogen until pre-charge pressure setting is reached, then close bleed valve **A** (Figure 1.) by turning clockwise until completely closed.

12. Close valve **B (**Figure 1.) clockwise until fully closed (to a maximum 14.75 foot pounds of torque) making sure the socket-headed gas valve is tight, bleed the trapped pressure in the gas line to zero by means of bleed valve **A** (Figure 1.), open valve **A** (Figure 1.), counter-clockwise until the gauge reads 0 psig, close bleed valve **A** (Figure 1.) by turning clockwise until completely closed.

13. Disconnect the end of gas hose from the non-return valve **C** (Figure 1.) and replace its cap, remove the gas valve adapter / hose assembly from the nitrogen bottle (Figure 2.).

14. Remove the charging unit from the gas fill valve on the accumulator by means of knurled cap **D** (Figure 1.) turn counter-clockwise until removed.

15. Using the 6mm hexagon wrench supplied in Stauff' Charging Kit # STDA-CK-M-1, ensure that the metric M28x1.5 socket-headed gas valve is firmly tightened to a maximum of 14.75 foot pounds of torque.

16. Reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

17. **Note:** When charging Stauff Diaphragm accumulators with a North American style gas valve please refer to pre-charging instructions for Stauff Diaphragm Accumulators with North American Style Gas Valves.

NOTE: Allow the accumulator to rest for approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safely glasses.

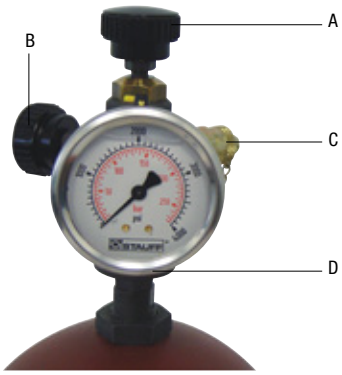


Figure 1.


Figure 2.

Checking Pre-Charge Pressure

General Information

The condition of the accumulator is primarily determined by periodic checking of pre-charge pressure. Only qualified personnel should perform any maintenance on accumulators. Nitrogen gas pre-charge pressure should be checked at least once during the first week of operation to assure that no leak has developed. The pre-charge pressure and ambient temperature should be recorded at installation. If there is no loss of gas pre-charge pressure, it should be rechecked in approximately 4 months. Thereafter, it should be checked annually. Check pre-charge if the system is acting sluggishly. If pre-charge is low, check the gas valve for leakage and recharge.

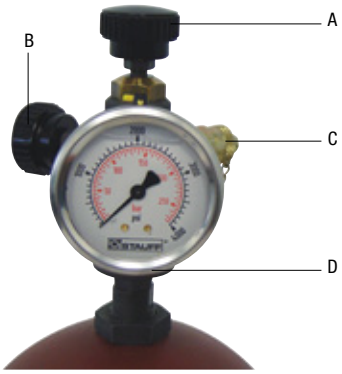


Figure 1.

Pre-Charge Checking Procedure for Diaphragm Accumulators with Metric M28 x 1.5 Gas Valve

1. Use appropriate valving in the hydraulic system, to discharge all hydraulic fluid from accumulator.

2. To check or adjust pre-charge pressure, HYDRAULIC PRESSURE MUST BE REDUCTED TO 0 PSIG. Pre-charge pressure should be checked periodically. Charging and checking should be done with an accumulator gauge assembly kit similar to Stauff Part # STDA-CK-P3.

DANGER: DO NOT attempt to remove the accumulator gas valve screw with a hexagon wrench, as it could be ejected under very high pressure.

3. Follow pre-charging instructions for Diaphragm Accumulators with M28x1.5 Style Gas Valves instructions #4 through #15.

4. Reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

NOTE: Allow the accumulator to rest approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safely glasses.

Checking Pre-Charge Pressure

General Information

The condition of the accumulator is primarily determined by periodic checking of pre-charge pressure. Only qualified personnel should perform any maintenance on accumulators. Nitrogen gas pre-charge pressure should be checked at least once during the first week of operation to assure that no leak has developed. The pre-charge pressure and ambient temperature should be recorded at installation. If there is no loss of gas pre-charge pressure, it should be rechecked in approximately 4 months. Thereafter, it should be checked annually. Check pre-charge if the system is acting sluggishly. If pre-charge is low, check the gas valve for leakage and recharge.

Pre-Charge Checking Procedure for Diaphragm Accumulators with US Style Gas Valve

1. Use appropriate valuing in the hydraulic system, to discharge all hydraulic fluid from accumulator.

2. To check or adjust pre-charge pressure, HYDRAULIC PRESSURE MUST BE REDUCTED 0 PSIG. Pre-charge pressure should be checked periodically. Charging and checking should be done with an accumulator gauge assembly kit similar to Stauff Part # STBA-CK-B/T-P3.

3. Follow pre-charging instructions for Diaphragm Accumulators with US Style Gas Valve - instructions #4 through #15.

4. Reinstall the gas valve cap and protective guard cap on the accumulator. The accumulator is now ready for use.

NOTE: Allow the accumulator to rest approximately 10-15 minutes after gas pre-charging. This will allow gas temperature to adjust and equalize. Recheck gas pressure and adjust if necessary. Check accumulator gas valve for any leaks with soapy water. Always wear safely glasses.

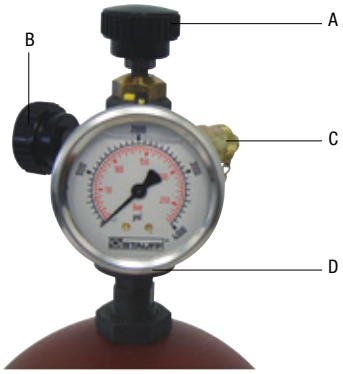


Figure 1.