Accumulators

BLADDER ACCUMULATORS

ACCESSORIES

INSTRUCTIONS

STAUFF®

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.

Material options & features

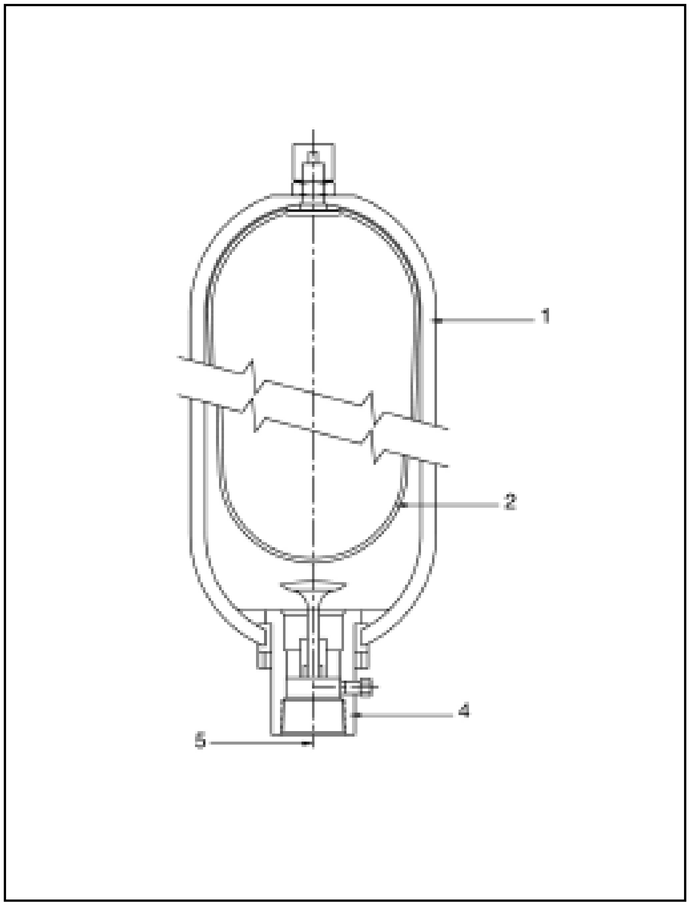
Main Components	Standard Material	Material Options	Features
Shell	• Chrome - Molybdenum Alloy Steel, (SA-372) • All Sizes Comply with ASME Materials Specifications	Consult Factory	• Meets 4-1 safety requirements • Seamless shell • 1 gallon and larger Supplied with ASME Certification • Available with Foreign or Domestic Certificates (Consult Stauff)
Bladder	• Low temperature Buna-N (LTB)	Viton - (V) EPR - (E) Hi-Temp Buna (HTB) Consult Factory for other options	• 1 piece fully enclosed molded bladder • With molded steel valve stems • Wide range of operating temperatures
Oil Port Assembly	• AISI 4130 material spec.	Consult Factory	• Proven design and reliability • Port options available, refer to ordering code

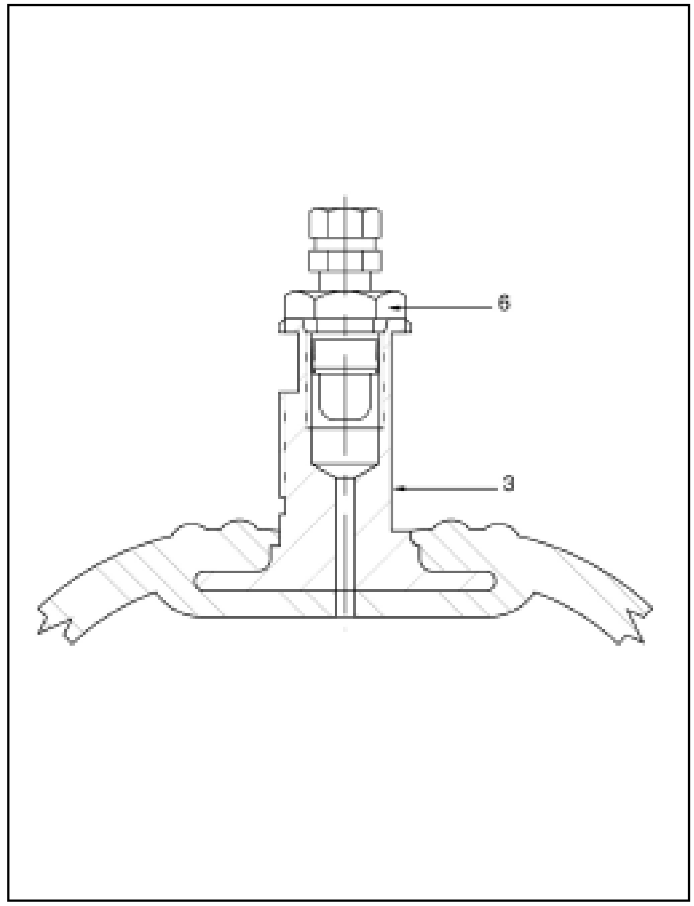
Bladder Accumulator Features

- 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.

Maximum Flow Rates

Size (gallon)	Max. Recommended Flow	
	GPM	LPM
1 QRT	40	150
1	150	565
21/2 - 15	220	830





1. Shell
Bladder 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 as standard.

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 components to meet a wide range of fluids and operating temperatures. Stauffs standard material is low temperature Buna –N (LTB).

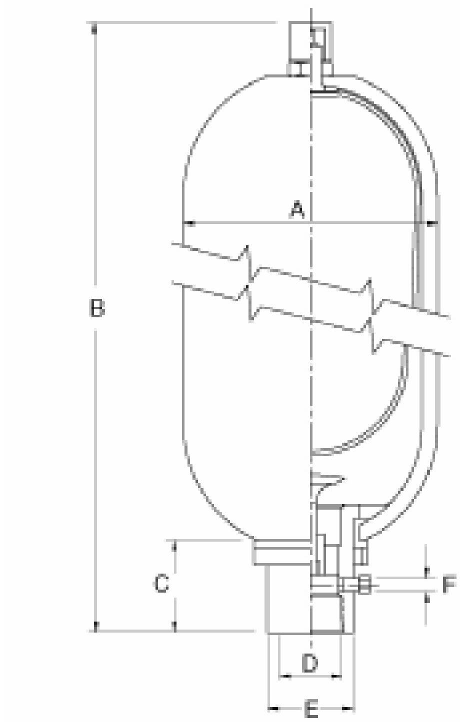
3. Bladder Stems
All bladder accumulators, sizes 1 gallon and larger, are fitted as standard with two-piece bladder stems with replaceable gas valve cartridge for ease of serviceability.

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 Adapters are available (See page 9). Bleeder ports (plugged) are included as standard on 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. For safety, the gas valve vents if unscrewed.

3000 PSI / *207 Bar* Bottom Repairable



Nominal Capacity *Gallons* (Liters)	Gas Volume *in³* (cm³)	Max. W.P. *PSI* (bar)	Dimensions										Net Weight	
			A		B		C		D	E		F	Lbs.	Kg.
			in	mm	in	mm	in	mm	SAE	in	mm	SAE		
*1 Qt. (1.0)	68.4 (1190)	3000 (207)	4.60	117	11.75	298	2.16	55	#12 (1-1/16"-12)	1.65	42	N/A	10	4.5
1.0 (4.0)	226 (3845)	3000 (207)	6.60	168	17.00	432	3.63	92	#20 (1 5/8" - 12)	2.40	61	#6 (9/16 - 18)	34	15
2.5 (10)	555 (9620)	3000 (207)	9.00	229	20.50	520	3.75	95	#24 (1 7/8" - 12)	3.00	76	#6 (9/16 - 18)	95	43
5.0 (20)	1095 (19480)	3000 (207)	9.00	229	32.30	820	3.75	95	#24 (1 7/8" - 12)	3.00	76	#6 (9/16 - 18)	139	63
10 (40)	2080 (36560)	3000 (207)	9.00	229	53.50	1360	3.75	95	#24 (1 7/8" - 12)	3.00	76	#6 (9/16 - 18)	229	104
11 (44)	2360 (41210)	3000 (207)	9.00	229	59.50	1510	3.75	95	#24 (1 7/8" - 12)	3.00	76	#6 (9/16 - 18)	249	113
15 (60)	3460 (56396)	3000 (207)	9.00	229	77.16	1960	3.75	95	#24 (1 7/8" - 12)	3.00	76	#6 (9/16 - 18)	286	130

* In accordance with ASME VIII Calculations Only.

Bladder Accumulators Ordering Code

STA - S - 025 - B - P3 - U - LTB - 1

Model Code
STA - Stauff Accumulator

Type	
S	**ASME Type (North American) (Standard)**
E	European Type (optional)

Size (Capacity)	
1 Qt.	1 Quart
010	1 Gallon
025	2.5 Gallons
050	5 Gallons
100	10 Gallons
110	11 Gallons
150	15 Gallons

Style	
B	**Bottom Repairable (Standard)**
T	Top Repairable (optional)

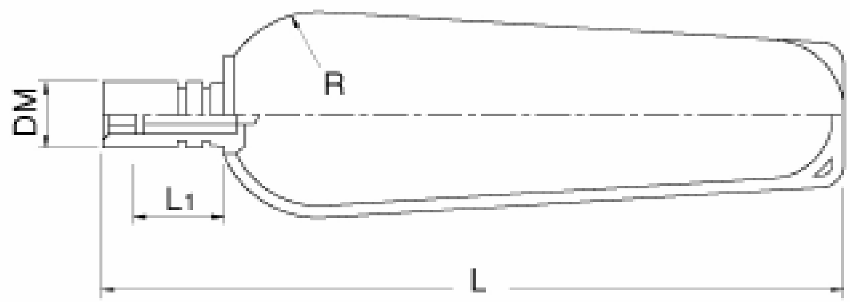
Pressure Rating	
P 3	***3000 PSI* / 207 bar (Standard)**
P 5	*5000 PSI* / 345 bar (optional)

Fluid Port Connection	
U	**SAE Thread (Standard)**
N	NPT Thread (optional - Available with SAE-NPT Adaptor) (See page 9)
F	Code 61 Split Flange (Optional) Available with Split Flange Adaptor (See page 9)

Bladder Material	
LTB	**Low Temp. Buna-N (Standard)**
HTB	High Temp. Buna-N (optional)
V	Viton (optional)
E	EPR (optional)

Design Code	
1	**Standard**
*	Special design No. to be assigned

3000 PSI / 207 Bar Bottom Repairable



Bladder Capacity & Dimensions								
Bladder Part Numbers	**Capacity**	**DM**	**L**		**L1**		**R**	
			in	mm	*in*	mm	*in*	mm
STA-B-1Qt. –P3-LTB (Buna-N) **STA-B-1Qt. –P3-V (Viton)**	1 Quart	5/8" UNF	*5.8*	147	*1.0*	26	*1.5*	38.5
STA-B-010-P3-LTB (Buna-N) **STA-B-010-P3-V (Viton)**	1 Gallon	7/8" UNF	*7.7*	195	*1.7*	42	*2.0*	50
STA-B-025-P3-LTB (Buna-N) **STA-B-025-P3-V (Viton)**	2.5 Gallons		*11.3*	286	*1.7*	42	*2.9*	74
STA-B-050-P3-LTB (Buna-N) **STA-B-050-P3-V (Viton)**	5 Gallons		*23.2*	589	*1.7*	42	*3.9*	100
STA-B-100-P3-LTB (Buna-N) **STA-B-100-P3-V (Viton)**	10 Gallons		*43.6*	1108	*1.7*	42	*3.9*	100
STA-B-110-P3-LTB (Buna-N) **STA-B-110-P3-V (Viton)**	11 Gallons		*49.5*	1258	*1.7*	42	*3.9*	100
STA-B-150-P3-LTB (Buna-N) **STA-B-150-P3-V (Viton)**	15 Gallons		*67.4*	1711	*1.7*	42	*3.9*	100

* All above Bladder Kits include the following:
(1) Bladder (Specify Material), (1) Gas valve & "O" Ring, (1) Poppet valve "O" Ring, (1) Back-up seal "O" Ring

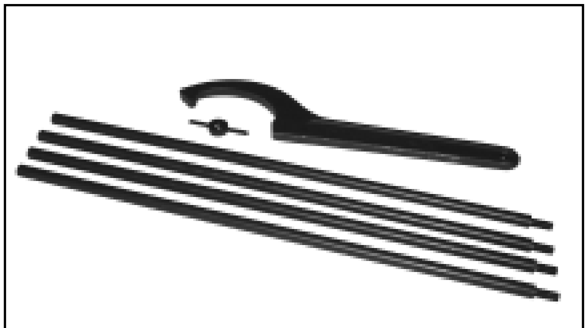
3000 PSI / 207 Bar Bottom Repairable

Charging Kits

Charging Kit Part # STA-CK-1

Charging kit includes the following items:
- Charging Assembly
- Fitting Adaptors for 5/8” - UNF
- Fitting Adaptors for 7/8” - UNF
- Pressure Gauge *(0 - 3700 PSI /* 0 - 250 bar*)*
- Plastic Case and Foam

Repair Kits



Repair Kit Part # STA-R-1

Repair kit includes the following parts:
- Set of pull rods
- Gas valve wrench
- Plastic case

Port Adapters (Flange Code #61)

SAE to Flange Connector (Code 61)	
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

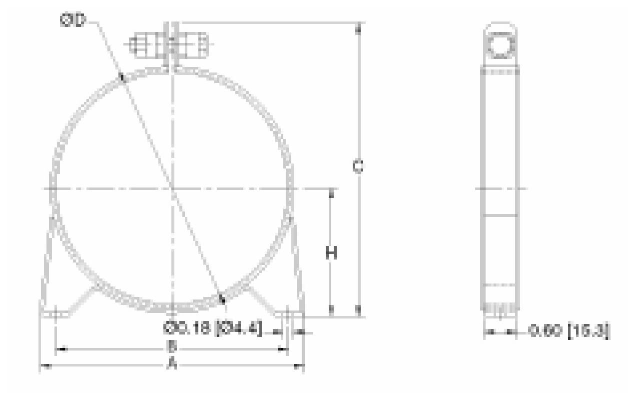
Split Flanges (Code 61)	
Part #	**Description**
SF3-12	3/4” Flange Size
SF3-20	1 1/4” Flange Size
SF3-24	1 1/2” Flange Size

Port Adapters (NPT)

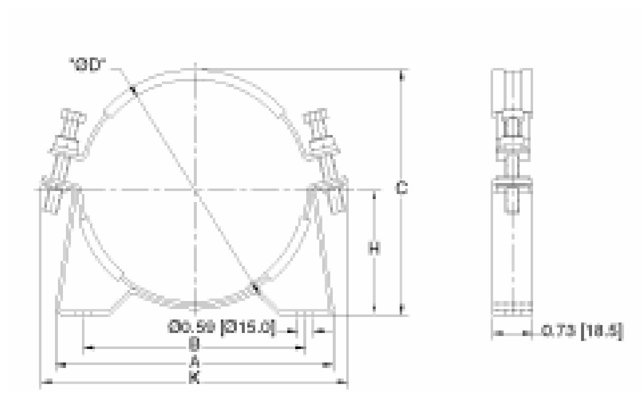
SAE to NPT Port Adapters	
Part #	**Description**
PA-U12M-N08F	#12 SAE to 1/2” NPT
PA-U12M-N12F	#12 SAE to 3/4” NPT
PA-U20M-N16F	#20 SAE to 1” NPT
PA-U20M-N20F	#20 SAE to 1-1/4” NPT
PA-U204M-N24F	#24 SAE to 1-1/2” NPT

Accumulator Brackets

Type AMP



Type AMP/D

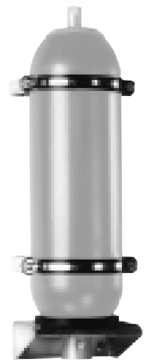


STAUFF PART NUMBER	DIMENSIONS													
	"ØD" Nom		"ØD" Min		"ØD" Max		A		B		C		H	
	in	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm
AMP108	*4.25*	108.0	*4.09*	104.0	*4.37*	111.0	*5.43*	138.0	*3.94*	100.0	*5.91*	150.0	*2.52*	64.0
AMP114	*4.50*	114.0	*4.33*	110.0	*4.61*	117.0	*5.35*	136.0	*3.94*	100.0	*6.50*	165.0	*2.87*	73.0
AMP126	*4.96*	126.0	*4.76*	121.0	*5.08*	129.0	*6.89*	175.0	*5.35*	136.0	*6.89*	175.0	*3.03*	77.0
AMP146	*5.75*	146.0	*5.59*	142.0	*5.87*	149.0	*6.69*	170.0	*5.35*	136.0	*7.52*	191.0	*3.27*	83.0
AMP167	*6.57*	167.0	*6.45*	164.0	*6.81*	173.0	*7.28*	185.0	*6.02*	153.0	*8.31*	211.0	*3.64*	92.5
AMP175	*6.90*	175.0	*6.77*	172.0	*7.00*	178.0	*7.60*	193.0	*6.30*	160.0	*8.74*	222.0	*3.92*	99.5
AMP222	*8.74*	222.0	*8.50*	216.0	*9.02*	229.0	*10.0*	254.0	*8.50*	216.0	*10.47*	266.0	*4.72*	120.0

STAUFF PART NUMBER	DIMENSIONS															
	"ØD" Nom		"ØD" Min		"ØD" Max		A		B		C		H		K	
	in	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm
AMP/D206	*8.11*	206.0	*8.07*	205.0	*8.15*	207.0	*10.24*	260.0	*8.19*	208.0	*9.06*	230.0	*4.65*	118.0	*10.83*	275.0
AMP/D210	*8.39*	213.0	*8.35*	212.0	*8.43*	214.0	*10.63*	270.0	*8.50*	216.0	*9.37*	238.0	*4.84*	123.0	*11.22*	285.0
AMP/D219	*8.62*	219.0	*8.58*	218.0	*8.56*	220.0	*10.55*	268.0	*8.50*	216.0	*9.45*	240.0	*4.84*	123.0	*11.22*	285.0
AMP/D228	*8.90*	226.0	*8.86*	225.0	*8.94*	227.0	*10.63*	270.0	*8.50*	216.0	*9.61*	244.0	*4.84*	123.0	*11.61*	295.0
AMP/D242	*9.53*	242.0	*9.49*	241.0	*9.57*	243.0	*10.55*	268.0	*8.50*	216.0	*10.43*	265.0	*5.35*	136.0	*12.00*	305.0
AMP/D286	*11.26*	286.0	*11.22*	285.0	*11.30*	287.0	*13.07*	332.0	*11.02*	280.0	*12.36*	314.0	*6.42*	163.0	*13.98*	355.0
AMP/D310	*12.20*	310.0	*12.17*	309.0	*12.24*	311.0	*13.07*	332.0	*11.02*	280.0	13.11	*333.0*	6.69	*170.0*	*14.96*	380.0

Base Brackets & Rubber Rings

Type BB & RR Series

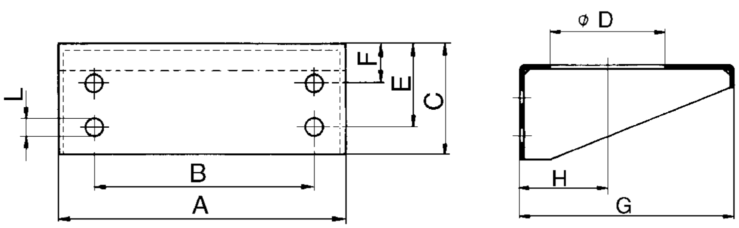


Specifications

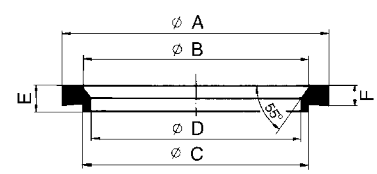
- Rubber Cushioning to reduce vibration and noise
- Compensation for thermal expansion and contraction
- Galvanized and painted to resist corrosion
- Special sizes and designs are available on request

Dimensions / Ordering Information

Base Bracket



Rubber Ring



Base Bracket with rubber ring (to specify base bracket less rubber ring remove "r" from model number)

Model	Dimensions in inches																		Weight	
	A		B		C		D		E		F		G		H		I			
	in	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*in*	mm	*lbs.*	kg.
BB120R	*10.24*	260	*7.87*	200	*3.94*	100	*4.69*	119	*2.95*	75	*1.38*	35	*8.86*	225	*3.62*	92	*.67*	17	*5.5*	2.5
BB170R	*10.24*	260	*7.88*	200	*3.94*	100	*6.65*	169	*2.95*	75	*1.38*	35	*8.86*	225	*4.84*	123	*.67*	17	*5.5*	2.5
BB211R	*15.35*	390	*10.63*	270	*9.45*	240	*8.31*	211	*7.09*	180	*2.36*	60	*15.35*	390	*7.68*	195	*.87*	22	*44.4*	20
	Rubber Ring																			
RR108	5.91		4.72		4.72		4.25		.79		.59									
RR160	7.87		6.69		6.69		6.60		.79		.59									
RR200	9.84		8.66		8.27		7.87		.98		.79									

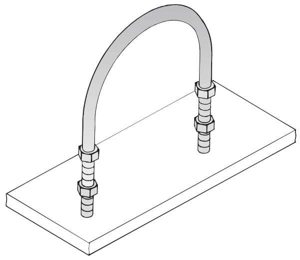
Bladder Accumulator Size	Clamp Number	Qty.	Dia. (in.)	Base Bracket
1 Quart	AMP114	1	4.5	
1 Gallon	AMP172	1	6.7	BB120R
2.5 Gallon	AMPD228	1	9.0	BB170R
5 Gallon	AMPD228	2	9.0	BB170R
10 Gallon	AMPD228	2	9.0	BB170R
11 Gallon	AMPD228	2	9.0	BB170R
15 Gallon	AMPD228	3	9.0	BB170R

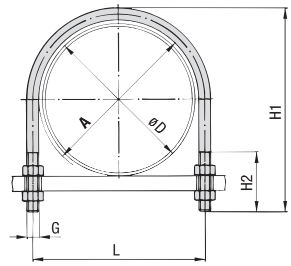
Piston Accumulator Size	Clamp Number	Qty.	Dia. (in.)	Base Bracket
1 Quart	AMP114	1	4.5	
2 Quart	AMP114	1	4.5	
	AMP114	2	4.5	
1 Gallon	AMP146	2	5.75	
	AMP175	1	6.9	BB120
	AMP114	2	4.5	
1.5 Gallon	AMP146	2	5.75	
	AMP175	1	6.9	BB120
2 Gallon	AMP114	2	4.5	
	AMP146	2	5.75	
2.5 Gallon	AMP175	1	6.9	BB120
	AMP206	1	8.0	BB170
	AMP146	2	5.75	

Piston Accumulator Size	Clamp Number	Qty.	Dia. (in.)	Base Bracket
5 Gallon	AMP146	3	5.75	
	AMP175	2	6.9	BB120
	AMPD206	1	8.0	BB170
	AMPD228	1	8.9	BB170
	AMP175	2	6.9	BB170
7.5 Gallon	AMP206	2	8.0	BB170
	AMPD228	1	8.9	BB170
10 Gallon	AMPD206	2	8.0	BB170
	AMPD228	2	8.9	BB170
15 Gallon	AMPD206	2	8.0	BB170
	AMPD228	2	8.9	BB170

Round Steel U-Bolts

Type BB & RR Series





Pipe - O.D. øD		Round Steel U-Bolt UBC									
	Nominal	A		L		H1		H2		G	
mm	Bore	mm	in	mm	in	mm	in	mm	in	mm	in
25		30	*1.18"*	40	*1.57"*	70	*2.75"*	40	*1.57"*	M10	*3/8" - 16*
26.9	*3/4"*										
30		38	*1.46"*	48	*1.88"*	76	*2.99"*				
33.4	*1"*										
38		46	*1.81"*	56	*2.20"*	86	*3.38"*	50	*1.96"*		
42.2	*1 1/4"*										
44.5		52	*2.04"*	62	*2.44"*	92	*3.62"*				
48.3	*1 1/2"*										
57		64	*2.51"*	76	*2.99"*	109	*4.29"*			M12	*7/16" - 4*
60.3	*2"*										
73	*2 1/2"*	82	*3.22"*	94	*3.70"*	125	*4.92"*				
88.9	*3"*	94	*3.70"*	106	*4.13"*	138	*5.43"*				
108		120	*4.72"*	136	*5.35"*	171	*6.73"*	60	*2.36"*	M16	*5/8" - 11*
114.3	*4"*										
133		148	*5.83"*	164	*6.46"*	191	*7.52"*				
141.3	*5"*										
159		176	*6.93"*	192	*7.56"*	217	*8.54"*				
168	*6"*										
193.7		202	*7.95"*	218	*8.58"*	249	*9.80"*				
216		228	*8.98"*	248	*9.76"*	283	*11.14"*	70	*2.75"*	M20	*3/4" - 10*
219	*8"*										
267		282	*11.10"*	302	*11.89"*	334	*13.15"*				
273	*10"*										
318		332	*13.07"*	352	*13.86"*	385	*15.16"*				
324	*12"*										
356	*14"*	378	*14.88"*	402	*15.83"*	435	*17.13"*			M24	*7/8" - 9*
368											
406	*16"*	428	*16.85"*	452	*17.80"*	487	*19.17"*				
419											
508		530	*20.87"*	554	21.81"	589	23.19"				
521											

Ordering Code

UBC xxxx ***

St 37	no surface finishing	- no further information
St 37	Fe/Zn 8C	- ZINC

Dimension A

Assembly consisting of:
1 x Round Steel U-Bolt
4 x Nuts DIN 934

Other materials and surface finishings on request.

Installation

• The accumulator in a hydraulic circuit should be placed as near as practical to the source of shock or potential energy requirement.
• Normally an accumulator should be installed in a vertical position with the oil connection down. If space is not available, it may be installed horizontally, however, reduced life may be incurred. Bladder type accumulators have an increased risk of the bladder bag floating (in the horizontal position), which traps usable fluid inside. The bladder can be pinched by the poppet valve closing, which may rupture the bladder. Horizontal position requires more care when draining the fluid from the accumulator.
• When installing an accumulator using “U” bolt type clamps, care should be exercised so as not to distort the accumulator with excessive tighting force.
• Welding hangers to the accumulator is not recommended. Mounting brackets are available from Stauff (See pages 10 & 11).
• The hydraulic fluid used must be kept free of foreign matter to prevent damaging the accumulator wall. For maximum seal life, the fluid should be filtered to 10 micron or less.
• It is not advisable to change the hydraulic fluid from that for which the accumulator was originally purchased for without checking its compatibility with the seal and bladder materials.

PRECHARGING 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 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 psig”.
• Always observe the maximum working pressure and operating temperature ranges.

Do not use oxygen for pre-charging the Accumulator!

Pre-charging Bladder Accumulators

(A) Isolate the accumulator from the system and make sure hydraulic fluid pressure is zero.
(B) Remove gas valve protection guard and valve cap from the accumulator.
(C) To charge the accumulator, use a charging hose and gauge assembly similar to Stauff Charging Kit # STA-CK-1 rated for 3,000 psig maximum (higher pressure kits are available).
(D) Before using the charging assembly (Figure 1.) make sure that valve **A** is completely open (counter-clockwise), that bleed valve **B** (Figure 1.) is closed and that the non-return valve **C** (Figure 1.) is completely closed.
(E) Connect the charging unit to the gas fill valve on the accumulator by means of knurled cap **D** (Figure 1.).
(F) Fit the gas valve adaptor (included in Stauff charging kit) to the nitrogen bottle, make sure that the gas valve on the nitrogen bottle is closed (see Figure 2.) then attach gas hose to the gas valve adaptor on the nitrogen bottle.
(G) Connect the other end of gas hose to the non-return valve **C** (Figure 1.), after taking off it’s cap.
(H) SLOWLY open valve on nitrogen bottle (Figure 2.) and allow the gas to flow to the accumulator.
(I) Turn valve A (Figure 1.) clockwise to the point where pressure is registered on the gauge.
(J) Once the desired gas pre-charge pressure has been reached, close valve on nitrogen bottle (Figure 2).

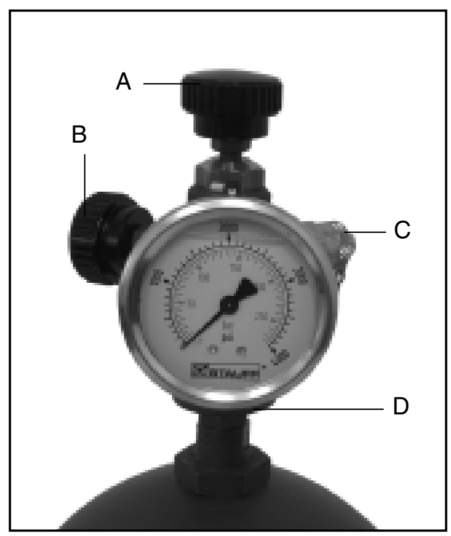


Figure 1.

NEXT

(K) Open valve A (Figure 1.) (counter-clockwise) and reduce the pressure to zero by means of bleed valve **B** (Figure 1.).
(L) Remove hose from non-return valve **C** (Figure 1.) and replace cap.
(M) Close the bleed valve **B** (Figure 1.) and wait a few minutes for pressure to stabilize.
(N) Screw valve **A** (Figure 1.) clockwise until pressure can be read on gauge. This should be slightly higher then the required pressure.
(O) Adjust pressure by means of bleed valve **B** (Figure 1.), then remove charging unit.
(P) Replace gas valve cap and protective guard on accumulator.
(Q) Accumulator is now ready for use.

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

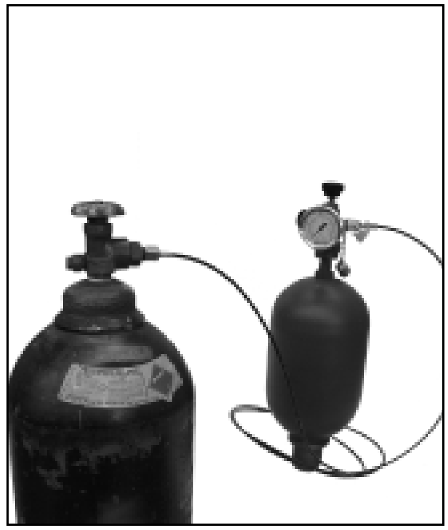


Figure 2.

MAINTENANCE

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 gas valve for leakage and recharge.

Bladder Accumulators

1. Use appropriate valving in the hydraulic system, to discharge all hydrauic fluid from accumulator.
2. To check or adjust pre-charge pressure, HYDRAULIC PRESSURE MUST BE REDUCED 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 # STA-CK-1.
3. Remove gas valve protection guard and valve cap as per pre-charge procedure instructions.
4. Attach gauge assembly to accumulator gas valve.
5. Make sure bleed valve B (Figure 1.) is closed, depress gas valve core by turning valve A (Figure 1.) clockwise. Gas pressure can now be read on gauge.
6. To reduce pressure, open bleed valve B (Figure 1.) carefully, allowing gas to escape until desired pressure is obtained.

NOTE: Allow accumulator to rest about 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.

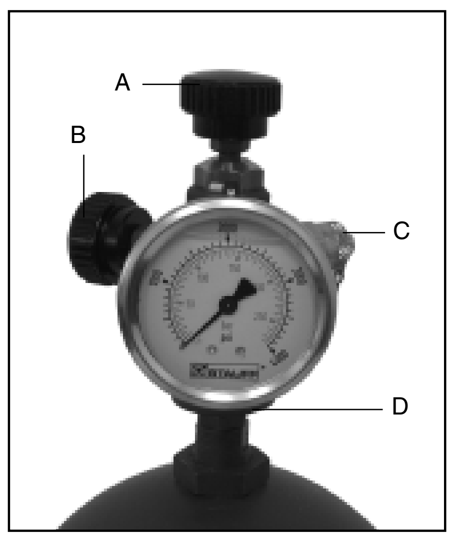


Figure 1.

DISASSEMBLING INSTRUCTIONS

Bladder Type

NOTE: It is good practice to disassemble and assemble accumulators in a clean area to keep all parts free of foreign matter.

1. Follow instructions for checking pre-charge, then release all pre-charge pressure.
2. Drain balance of hydraulic fluid that may be remaining in accumulator when it is disconnected from system.
3. Securely clamp the accumulator in place.
4. Remove bladder stem lock nut, nameplate, and gas valve from the top of the accumulator.
5. Remove the lock nut from the bottom of the accumulator using a spanner wrench (From Stauff Repair Kit Part # STA-R-1). Next remove spacer.
6. Push the plug and poppet assembly into accumulator shell.
7. Insert hand into accumulator shell and remove back-up, o-ring and metal back-up ring from plug. Remove anti-extrusion ring from plug, then fold in half and slide through shell opening.
8. Remove poppet plug assembly from shell.
9. Insert hand into the bottom of the accumulator shell opening. Compress bladder by hand to eliminate as much air volume as possible.
10. Pull the old or damaged bladder out of the bottom of the accumulator shell.
11. Inspect all parts and accumulator shell.

RE-ASSEMBLE INSTRUCTIONS

Bladder Type

1. Remove gas valve or valve core from new bladder.
2. Lubricate the inside of the shell and the outside of the bladder with clean system fluid. Also pour additional amount of fluid in the shell to act as a cushion.
3. Attach the bladder pull rod (as per Stauff Repair Kit Part # STA-R1) to the bladder stem.Pull the rod and bladder through the shell fluid port. Pull bladder stem out through the valve stem opening on the opposite end of the shell.
4. Slide the nameplate and lock nut over the pull rod and thread onto the bladder stem.Tighten lock nut. Remove the bladder pull rod.
5. Slide the plug/ poppet (poppet first) into the accumulator shell. Fold the anti-extrusion ring in half and slide it through the oil port opening. Place the anti-extrusion ring on the plug and poppet assembly with its stainless steel ring facing toward the shell opening.
6. Pull plug through accumulator shell opening. Using both hands, pull plug hard until it seats into position on shell opening.
7. Install gas valve or valve core into bladder stem. Using dry nitrogen, SLOWLY inflate the bladder bag with 5-10 psig of pressure to set and hold plug and poppet assembly in place.
8. Install metal washer onto plug and poppet assembly. Push into shell opening until bottomed out.
9. Install o-ring over plug and poppet assembly and push into shell opening until bottomed out. DO NOT ROLL OR TWIST O-RING WHEN INSTALLING. Lubricate o-ring with system fluid or grease before installation.
10. Install back-up and spacer with small shoulder towards the accumulator shell.
11. Install lock nut on plug and poppet assembly and tighten securely with a spanner wrench.
12. Replace bleeder plug into plug and poppet assembly.
13. For pre-charging refer to “Pre-charging Procedure” for bladder type.

Sizing Accumulators

In selecting the proper accumulator size V_1 (size of accumulator in cubic inches) when V_w (volulme of fluid to be discharged from accumulator) is known.

$$V_1 = \frac{(V_w)(E)}{f}$$

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

For Supplementing Pump
E = 1.24 for bladder accumulators.

For Auxilliary 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 (Claculate “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 17 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 Pages 18.)

Isothermal Operations

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:
$a = \frac{P3}{P2}$ = working pressure ratio
P3 = Mamimum system pressure
P2 = Minimum system pressure

NEXT

Discharge Coeffficient

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

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

	“n” Values											
a 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

   $\frac{P_2 + P_3}{2}$ = Average System Pressure

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

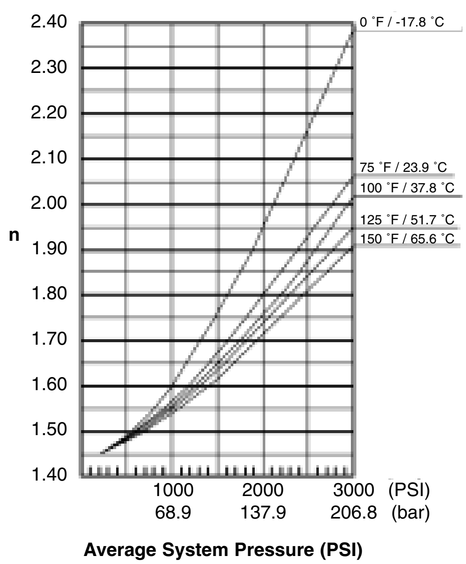
3. Select the graph which corresponds to the time (sec.) required to discharge the accumulator.

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.)

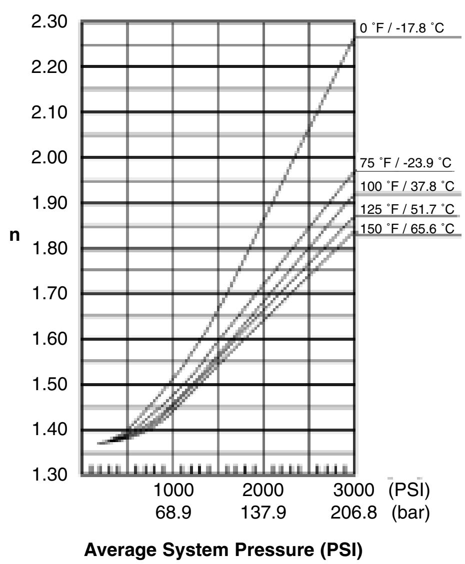
5. To use the graph, locate the average system pressure along the bottom portion of the graph. Move vertically along this column until you intersect the line corresponding to the gas temperature. Then move horizontally along this line and read the discharge coefficient to the left side of the graph.

Selection Charts for Discharge Coefficient “n”

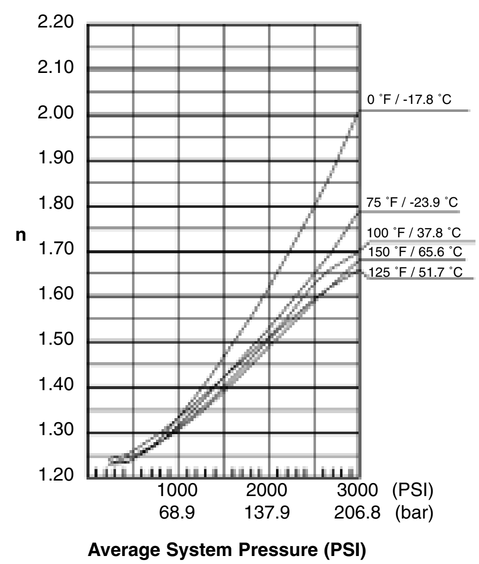
0 - 8 Seconds



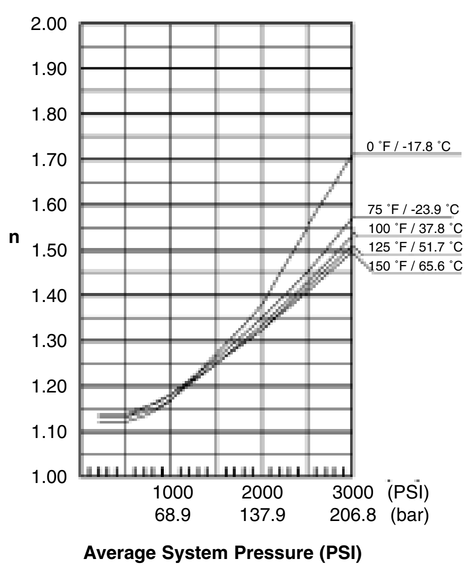
9 - 30 Seconds



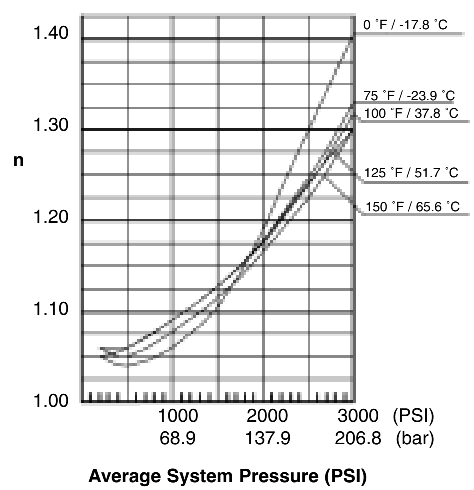
31 - 60 Seconds



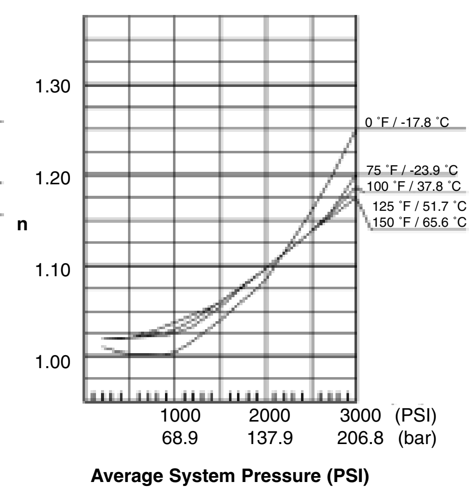
61 - 120 Seconds



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). Dewell 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) = Mimimum 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 in^3/ 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 requied from accumulator

a = 2 = $\frac{P_3}{P_2}$ = working pressure ratio

n = 1.65 = From Page 18

f = .3430 = From Page 17 (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 16).

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

NEXT

Once V_1 has been determined, select the accumulator from Page 7 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) = Mimimum 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) = oil requied from accumulator

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 18

f = .3196 = From Page 17 (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 16).

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

Where V_1 = Accumulator size required in cubic inches

Once V_1 has been determined, select the accumulator from Page 7 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.

NEXT

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. Using standard petroleum oil (54.3 lbs/ft³). What size of accumulator (V_1) would be required to limit shock pressure to 10% above system pressure P_2?

Information Required:

L = 80 ft. = Length of pipe between pump and valve causing shock.
A = 1.4 in² = Interanl area of pipe
P_2 = *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 18. Use 0-8 second curves.

VT = 0.78 ft³ = $\frac{(L)\ (A)}{144}$ = Total volume of oil in pipe

WT = 54.3 lbs/ ft³ = 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 17 (Table 2) (Opposite the "n" value selected)

Solution:

$$V_1\ (in^3) = \frac{(Vw)\ (E)}{f} = \text{Size of accumulator required}$$

$$V1 = \frac{(V)^2\ (W)\ (n-1)\ (.205)}{(P2)\ (C3)}$$

$$V1 = \frac{(27.5)^2\ (42.2)\ (1.80-1)\ (.205)}{(2200)\ (.0447)} = 53.2\ in^3 \text{ or } .23 \text{ Gallons}$$

A 1 Qt. accumulator would satisfy the system.

P1 gas pre-charge pressure should normally be 60% of P2, (in a shock suppression application).