

## Accumulators



Industrial Hydraulics

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## 1. Applications

Accumulators are devices used to store fluid power to do the following:

1. Store power for intermittent duty cycles thus economizing pump drive power
2. Provide emergency or standby power
3. Compensate for leakage loss
4. Suspension in vehicles
5. Dampen pulsations and shocks of a periodic nature

## 2. Principals of Operation

Most hydraulic systems require variable and intermittent flow rates. Energy can be saved by using the accumulator as a storage device to accept pump output flow when system demand is low and supplement output when demand is high.

Most accumulator designs are based on the principle that gas is compressible and oil is nearly incompressible. Assume an inert gas, such as nitrogen, is contained under pressure in a vessel. If hydraulic fluid is pumped into that vessel at a higher pressure than that of the original gas, the nitrogen compresses as its pressure rises to that of the fluid being pumped. This increase in gas pressure is proportional to the decrease in volume.

The vessel now contains energy in that the volume of hydraulic fluid, stored against the pressure of compressed nitrogen gas, if released, will quickly be forced out of the vessel under the pressure of the expanding gas.

Hydro-pneumatic accumulators with the gas separated from the liquid by a piston, diaphragm or bladder are by far the most common type.

*To prevent auto ignition at high pressures, an inert gas such as dry nitrogen or helium should always be used.*

Diaphragm and bladder type accumulators differ in the structural design of the elastic separator and the pressure vessel.

## 3. Sizing and Calculations

The majority of applications use accumulators to store energy for intermittent duty cycles or to provide a source of emergency power. In either case, the problem is determining the optimum size and precharge of the accumulator.

Accumulator sizing is based on the gas charge. The change in gas volume and pressure determines the amount of liquid that can be added or withdrawn. However, unlike mechanical springs, compressing a gas tends to heat it, raising the pressure above what would be expected from compression alone. Expanding a gas tends to cool it, reducing the pressure below that caused by expansion alone. Either of these effects can substantially affect accumulator sizing. Expansion (or compression) of a gas resulting in a change of gas temperature produces *adiabatic* expansion. When an accumulator is discharged rapidly, there is not enough time for sufficient heat transfer through the accumulator walls and adiabatic expansion occurs.

If the expansion (or compression) occurs slowly, there is sufficient time for heat to be added (or subtracted) by the accumulator wall to maintain a constant gas temperature and *isothermal* expansion occurs. The median of these two states of expansion can be partially "adiabatic".

When carrying out the calculations for an accumulator, the following pressures are of primary importance:

$p_0$  = Gas pre-charge pressure at room temperature and with liquid chamber drained

$p_1$  = Minimum operating pressure

$p_2$  = Maximum operating pressure

The following relationships apply: the gas pre-charge pressure is to be slightly lower than the minimum hydraulic pressure so that the bladder does not continually contact the oil valve (wear).

$$p_0 \approx 0.9 p_1 \quad (1)$$

The maximum hydraulic pressure is not to exceed 4 times the pre-charge pressure; otherwise, the elasticity of the bladder or diaphragm will be adversely affected. Also, excessive changes in pressure result in considerable heating of the gas. Reducing the pressure differential between  $p_1$  and  $p_2$  increases bladder service life. On the other hand, it must be taken into account that a lower pressure differential also reduces the utilization of available storage capacity.

Bladder-type accumulators

$$p_2 \leq 4 \cdot p_0 \quad (2.1)$$

Diaphragm-type accumulators

$$p_2 \leq 4 \cdot p_0 \quad (2.2)$$

**Oil volumes**

The gas volumes  $V_0 \dots V_2$  correspond to the pressures  $p_0 \dots p_2$ . Here,  $V_0$  is the rated volume of the accumulator.

The available oil volume  $\Delta V$  corresponds to the difference between the oil volume  $V_1$  and  $V_2$ .

$$\Delta V = V_2 - V_1 \quad (3)$$

The variable gas volume for a given pressure difference is determined according to the following equations:

a) For **isothermal change of state** of gases, the following equation applies:

$$p_0 \cdot V_0 = p_1 \cdot V_1 = p_2 \cdot V_2 \quad (4.1)$$

The isothermal equation is used when the change in the gas volume takes place so slowly that there is sufficient time for the complete exchange of heat to take place between the nitrogen and its surroundings. The result is a constant temperature.

b) For **adiabatic change of state** of gases, the following formula applies:

$$p_0 \cdot V_0^n = p_1 \cdot V_1^n = p_2 \cdot V_2^n \quad (4.2)$$

$n$  = relationship of the specific heats of the gas (adiabatic component);  $n = 1.4$  for nitrogen. The equation for adiabatic change of state is used when the change in the gas volume takes place so rapidly that the temperature of the nitrogen also changes.

In most cases the changes of state tend to follow the adiabatic rather than the isothermal laws. It is often the case that the charge takes place isothermally and the discharge adiabatically. Considering the equations (1) and (2),  $\Delta V$  is about 50 to 70% of the rated accumulator volume. The following formula can act as a guideline for sizing accumulators:

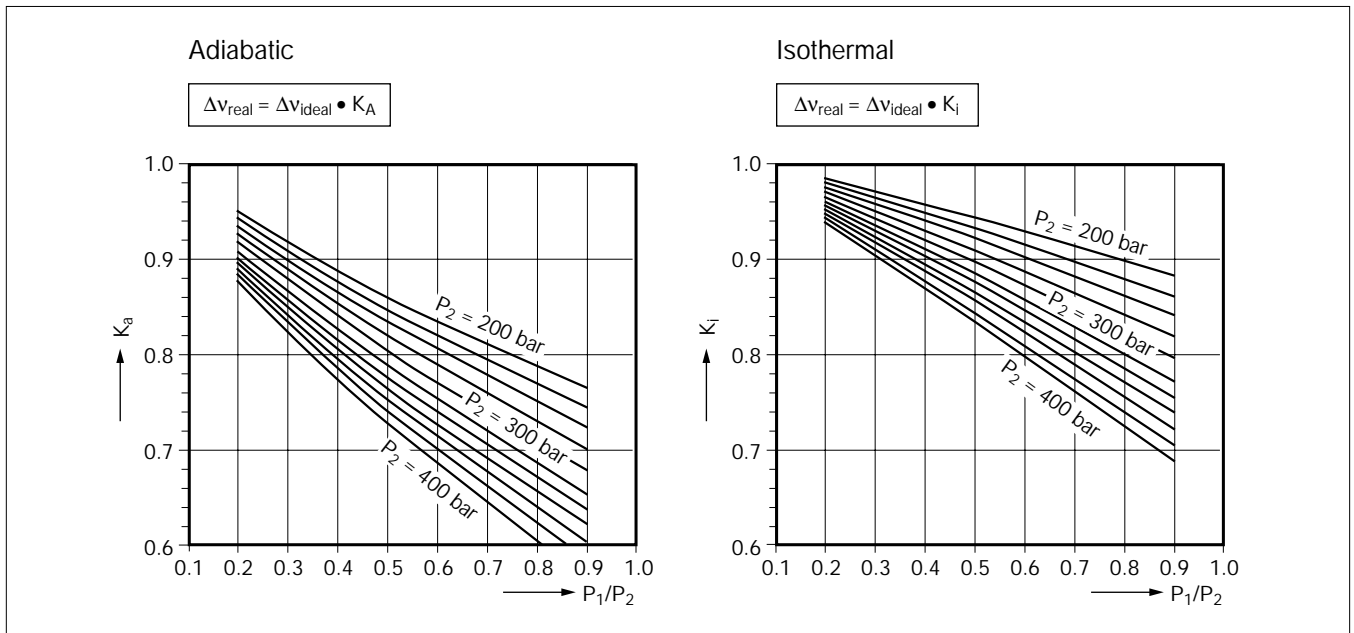
$$V_0 = 1.5 \dots 3x \Delta V \quad (5)$$

**Calculation diagrams**

The formulae (4.1) and (4.2) are converted into diagrams on pages 4 to 6 for graphic calculation purposes. Depending on the type of problem, the available oil volume, the accumulator size or the pressures can be determined.

**Correction factors  $K_i$  and  $K_a$**

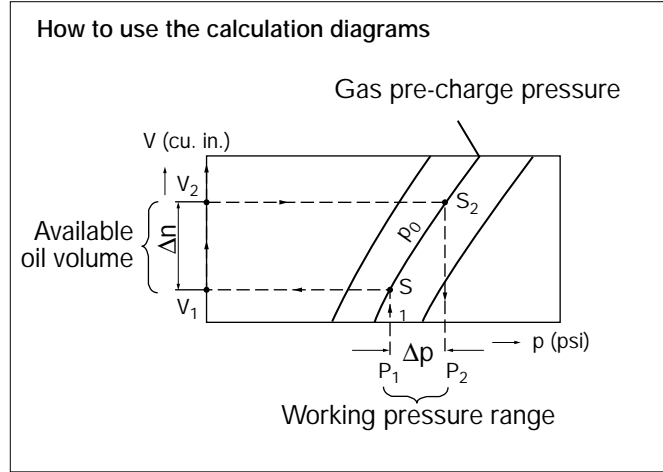
The formulae (4.1) and (4.2) apply to ideal gases only. In practice, at pressures above 200 bar (2900 psi), the behavior of real gases deviates markedly from that of the ideal gases. This makes it necessary to use correction factors. These are to be taken from the following diagrams. The correction factors, with which the ideal discharge volume  $\Delta V$  must be multiplied, are in the range of 0.6 ... 1.



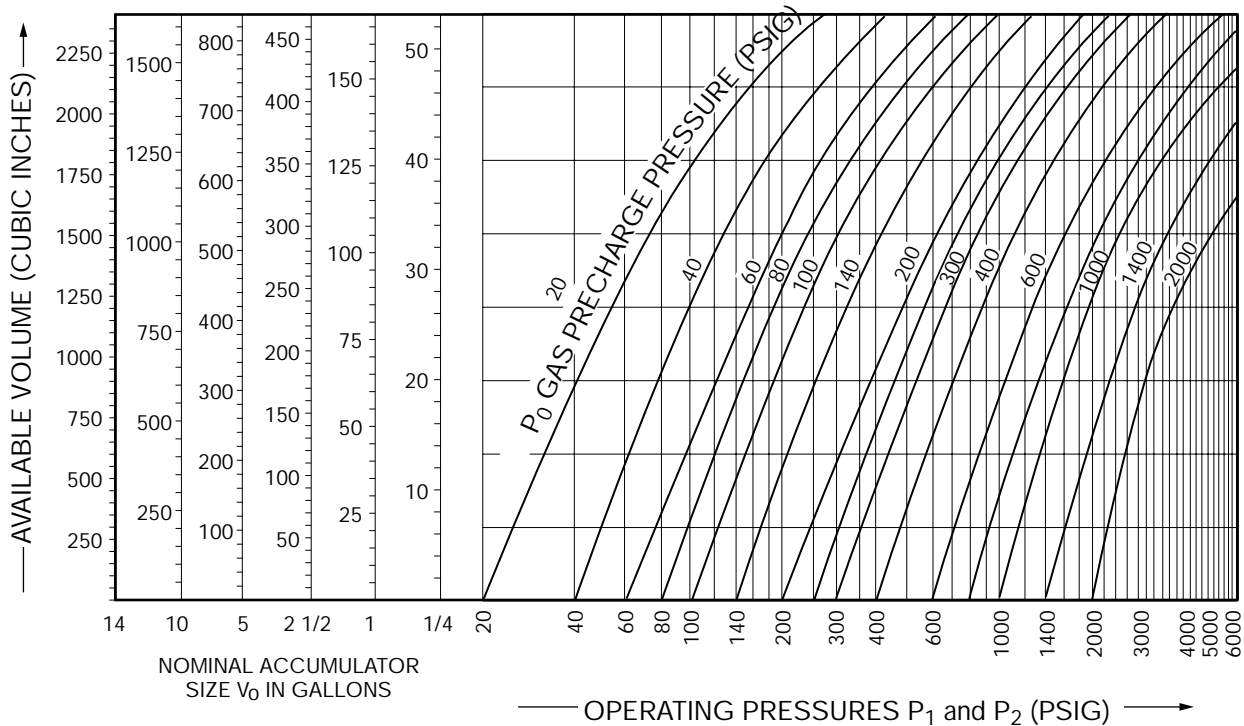
**Using the Diagrams**

With the pre-charge pressure ( $p_0$ ) and the minimum and maximum system pressures ( $p_1$  and  $p_2$ ) known, the available volume can be determined from the charts. Vertical lines are drawn from  $p_1$  and  $p_2$  to intersect the appropriate pre-charge curve. From the points of intersection, horizontal lines are then drawn to the left axis. Here  $V_1$  and  $V_2$  can be determined for the various sizes of accumulators. The difference between these values is the available volume.

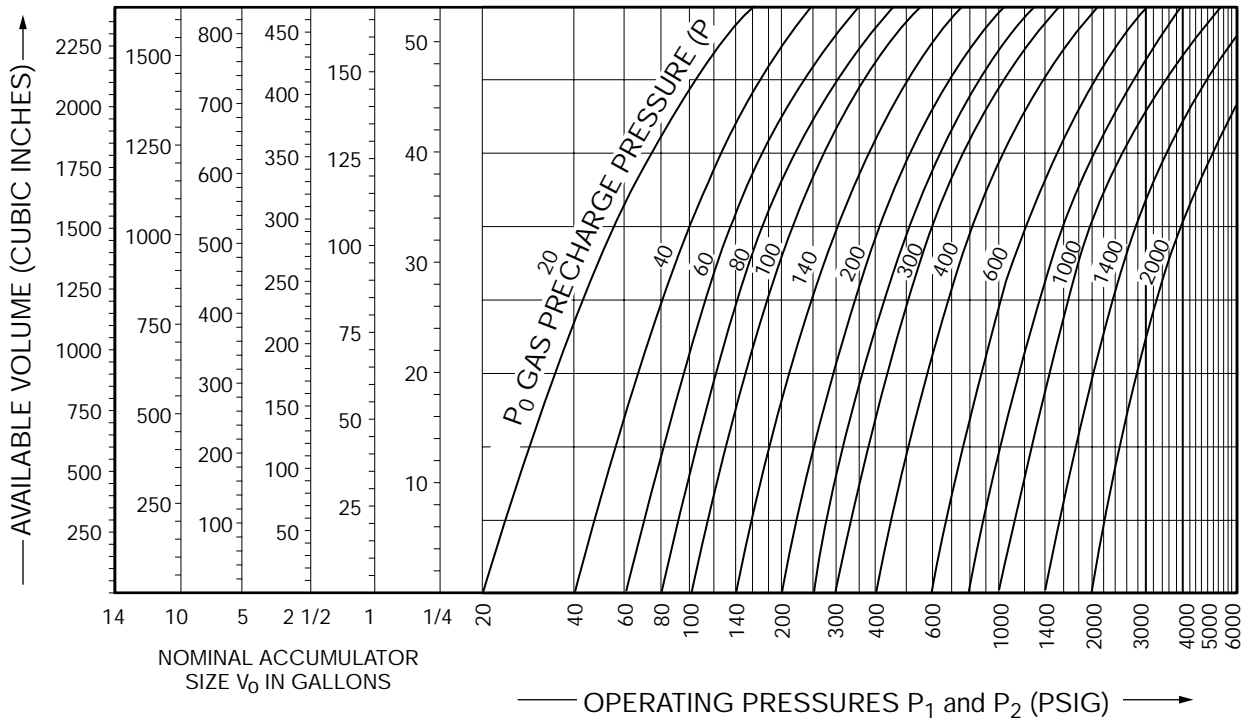
Similarly, pressures can be determined if the volume is known.



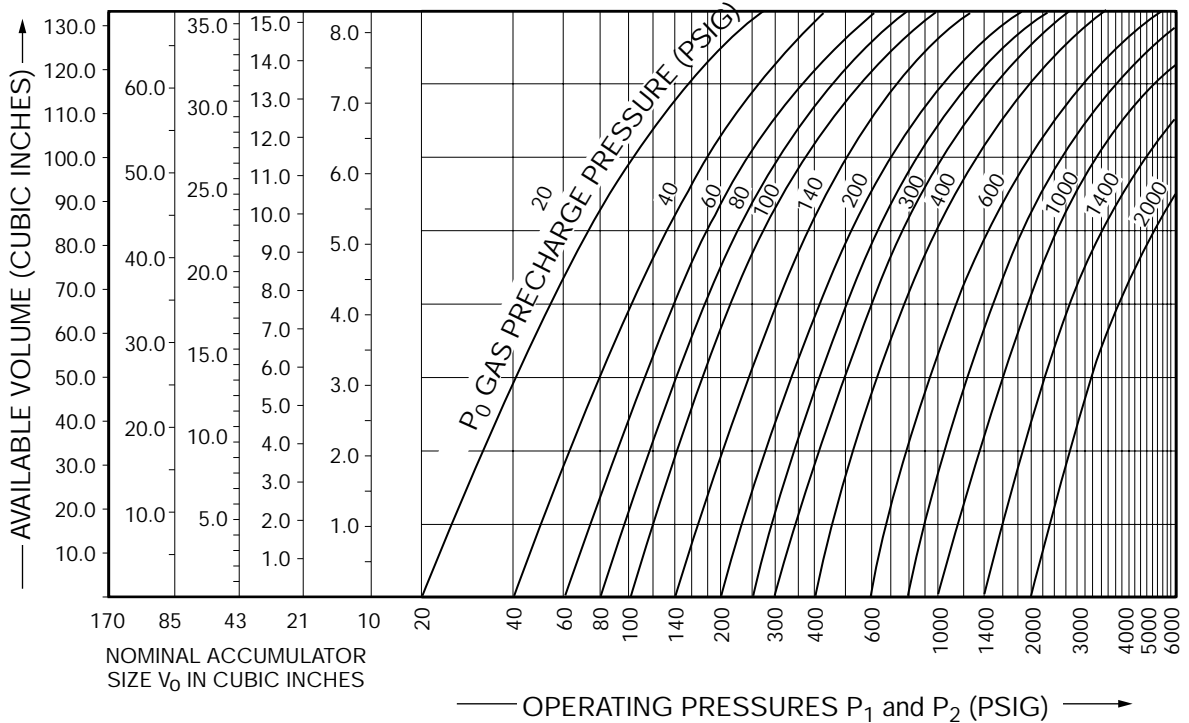
**PRESSURE-VOLUME CURVE, ADIABATIC RELATIONSHIP, Bladder Type Accumulator**



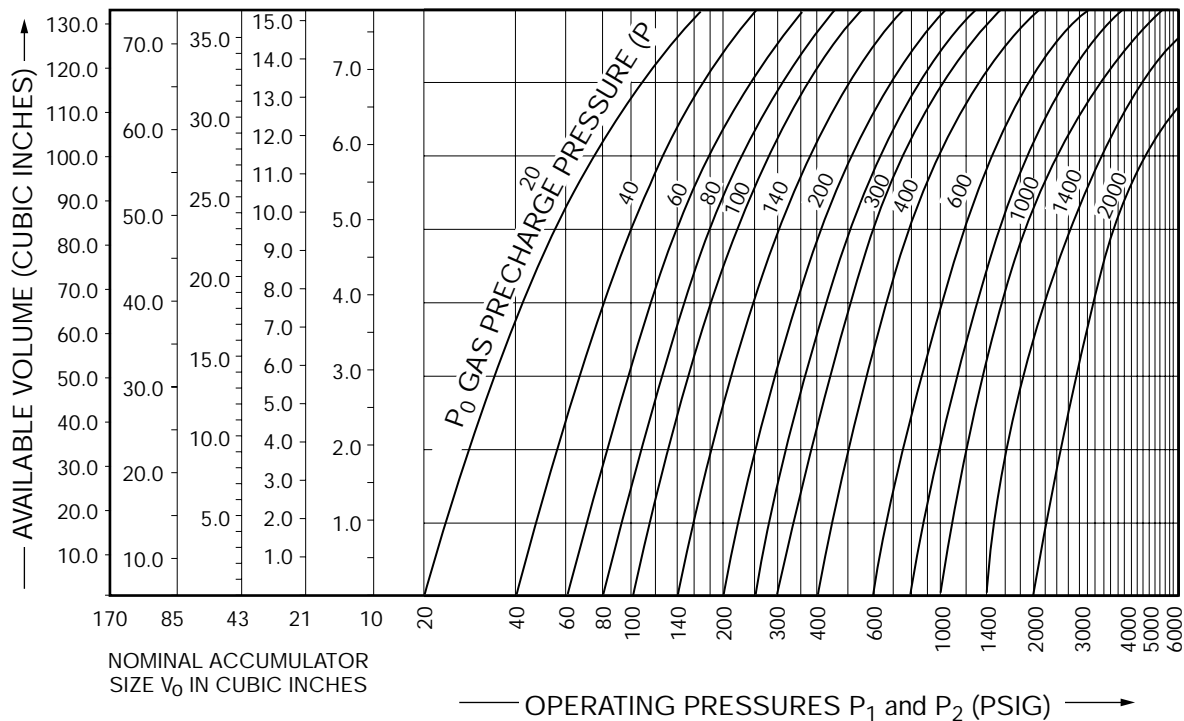
**PRESSURE-VOLUME CURVE, ISOTHERMAL RELATIONSHIP, Bladder Type Accumulator**



**PRESSURE-VOLUME CURVE, ADIABATIC RELATIONSHIP, Diaphragm Type Accumulator**



PRESSURE-VOLUME CURVE, ISOTHERMAL RELATIONSHIP, Diaphragm Type Accumulator



## Installation and Operating Instructions

### Mounting and Installation

**BLADDER TYPE ACCUMULATORS MUST BE MOUNTED IN A VERTICAL POSITION WITH THE OIL VALVE AT THE BOTTOM. PLEASE CONSULT THE FACTORY IF OTHER MOUNTING POSITIONS ARE NECESSARY.**

Mounting of Diaphragm Accumulators is unrestricted. All accumulators must be rigidly installed using clamps and support brackets specifically designed for accumulator mounting. Oil valve ports must not be used to support the weight of the accumulator.

**CAUTION - DO NOT** use gas or oil valves as lifting points. The accumulator shell is a pressure vessel and must not be altered. **DO NOT** weld or machine pressure vessels.

Improper installation may result in damage to the oil or gas valve, accumulator shell, or seals. Exercise care not to paint over rating nameplate or the warning label.

### General

Hydraulic circuits incorporating accumulators may store hydraulic oil under pressure depending on the function of the accumulator in the system. Therefore, the system may remain pressurized after the pump is turned off.

**CAUTION - Prior to performing any maintenance or system modifications, bleed off any stored system pressure.**

**Completely release all hydraulic fluid pressure in a safe controlled manner using appropriate valving. Installation of an automatic accumulator discharge valve in the hydraulic circuit is recommended.**

**Accumulator repairs must be performed by trained hydraulic service personnel experienced in servicing accumulators. Contact your local authorized distributor for application or repair assistance.**

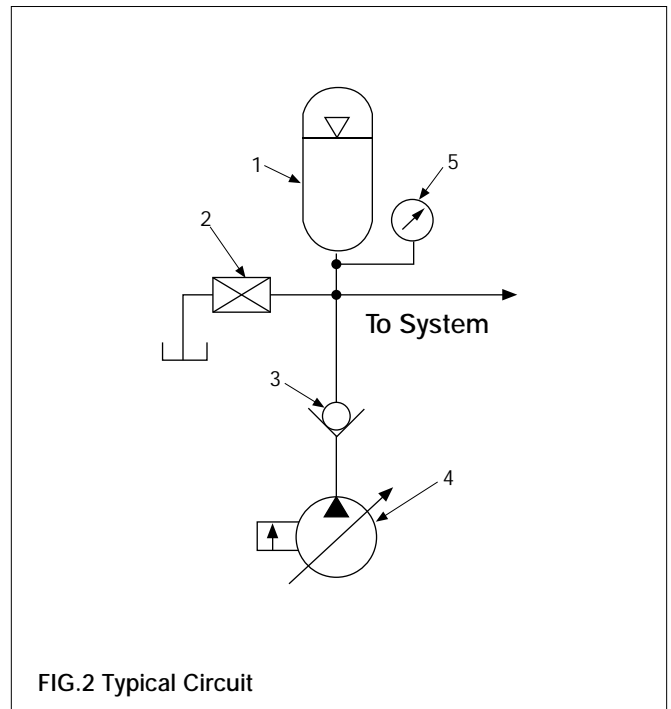
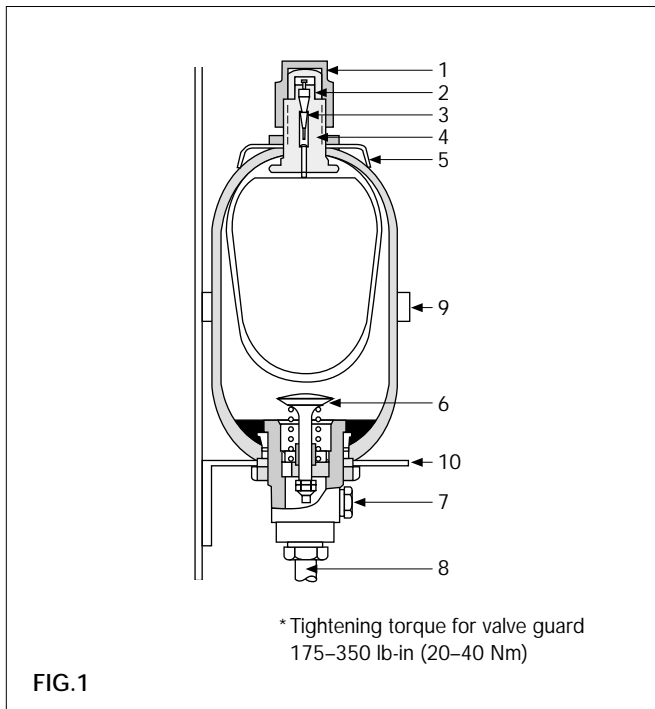
### Bladder accumulators

Bladder type are generally delivered with a nitrogen pre-charge pressure of approximately 50 psi (3 bar). After installation and prior to initial start-up, the pre-charge pressure ( $p_0$ ) must be set to the application requirements, or machine manufacturer's specifications.

### Diaphragm accumulators

Diaphragm type are generally delivered without pre-charge pressure. The pre-charge pressure must be set to the application requirements or machine manufacturer's specifications prior to initial start-up.

**CAUTION - Improper accumulator pre-charge may result in decreased life or failure of the bladder or diaphragm.**



- |                   |                     |
|-------------------|---------------------|
| 1. Valve guard*   | 6. Poppet valve     |
| 2. Valve cap      | 7. Gauge port       |
| 3. Gas valve core | 8. Hydraulic line   |
| 4. Gas valve body | 9. Clamp            |
| 5. Name plate     | 10. Support bracket |

- |                                       |                       |
|---------------------------------------|-----------------------|
| 1. Accumulator                        | 3. Check valve        |
| 2. Bleed or automatic discharge valve | 4. Pump               |
|                                       | 5. Oil pressure gauge |

**Checking the gas pre-charge pressure**

Bleed off hydraulic system pressure. After the accumulator has been put in service, the pre-charge pressure ( $p_0$ ) should be checked with an accumulator charging and testing device at least once in the first week. If this check reveals no loss in pressure, the pre-charge should be checked on the following schedule:

1 <sup>st</sup> Check	1 week
2 <sup>nd</sup> Check	3 months
3 <sup>rd</sup> Check	1 year
4 <sup>th</sup> & Continued	yearly

If the gas pre-charge is low, investigate cause and correct. Possible causes of lost pre-charge pressure include leaking or damaged gas valve, or damaged bladder.

**Testing pre-charge pressure “ $p_0$ ”**

Completely release accumulator hydraulic system pressure in a safe controlled manner. Install the charging and testing device onto the gas valve (see Fig. 1, Item #4). While depressing the button on the charging device, the gauge will indicate the gas pressure.

**Charging the accumulator**

**CAUTION - USE only NITROGEN for charging accumulators. NEVER USE OXYGEN OR AIR, due to the risk of explosion.**

Close the drain valve on the charging and testing device and connect the hose to the nitrogen bottle.

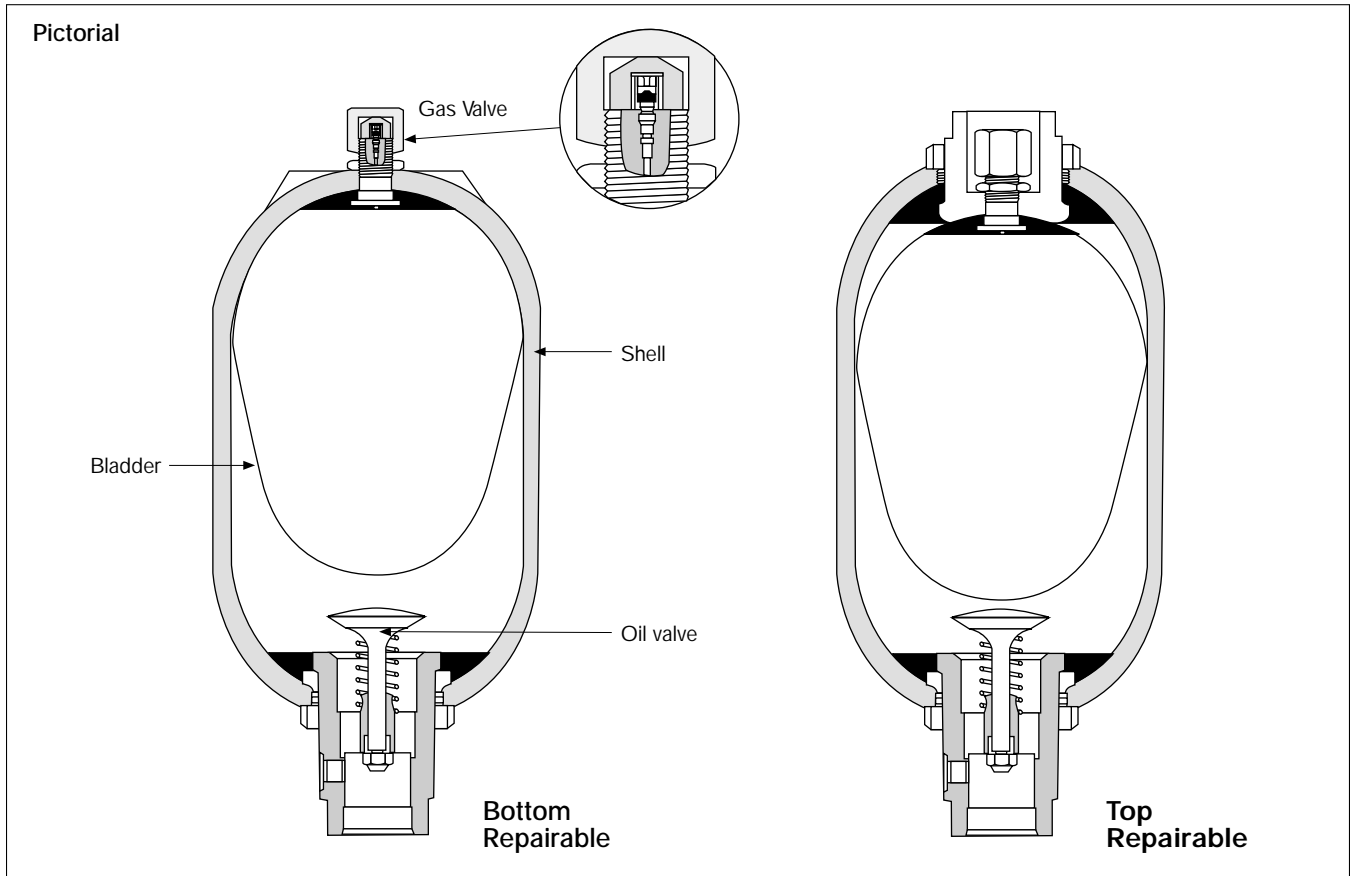
Remove the valve guard and cap and screw the charging and testing device onto the gas valve. More detail information is provided in the instruction sheet furnished with the charging and testing device. Open the gas shut-off valve on the nitrogen bottle and allow the gas to flow slowly into the accumulator. Close the shut-off valve frequently and check the value on the pre-charge by depressing the button on the charging device.

If the pre-charge pressure is too high, it may be reduced by opening the drain valve and carefully depressing the button on the charging device.

**NOTE:** The pre-charge pressure will vary depending on the gas temperature. Once the desired pre-charge is reached, it is necessary to wait 2 minutes until the gas temperature has equalized. Once again the pre-charge pressure needs to be checked and adjusted if necessary.

Unscrew the charging and testing device and replace the valve guard and cap (see Fig. 1, Items #1 & 2) and torque to specifications. A check for leaks with a soapy solution should follow. If a leak is found, it should be repaired following recommended repair procedures. If the gas valve core is replaced, use only valve cores approved for accumulator service, NEVER USE AN AUTOMOTIVE TYPE VALVE CORE.





**Dimensional Data**

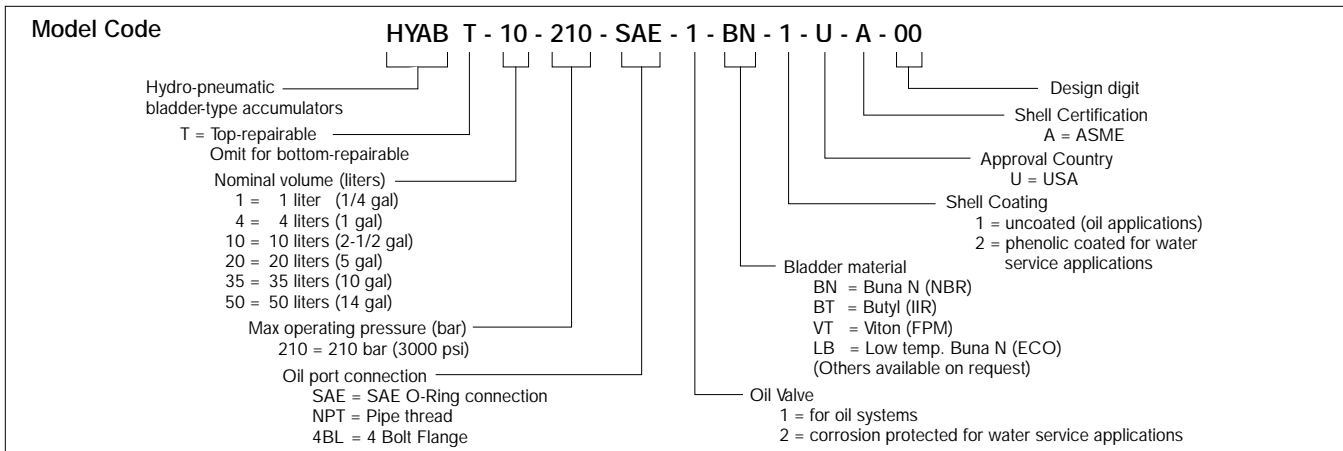
**Bottom Repairable**

DIMENSIONS (inches)								Wt. (lbs)
Size (gal)	A	B	C	D	E	F	G	
1/4	11.7	7.7	4.5	1.7	—	—	—	11
1	16.8	11.5	6.8	1.7	—	—	—	32
2-1/2	21.5	16.0	9.0	1.7	.375	2.0	2.81	72
5	33.8	28.3	9.0	1.7	.375	2.0	2.81	118
10	54.3	48.8	9.0	1.7	.375	2.0	2.81	196
14	74.0	68.4	9.0	1.7	.375	2.0	2.81	320

**Top Repairable**

DIMENSIONS (inches)								Wt. (lbs)
Size (gal)	A	B	C	D	E	F	G	
2-1/2	22.3	16.2	9.0	2.0	.375	2.0	2.81	72
5	34.5	28.4	9.0	2.0	.375	2.0	2.81	118
10	54.9	48.8	9.0	2.0	.375	2.0	2.81	196
14	74.6	68.5	9.0	2.0	.375	2.0	2.81	320

**4 Bolt Split Flange SAE J518 Code 61 (-32)**



**How to Order**

Bottom Repairable							
Size (gal)	Max. Press. (psi)	Material	NPTF Threads	Part Number	SAE Threads	Part Number	4 Bolt Flange Code 61 (-32)
1/4	3000	Buna N	3/4" NPT	0 531 112 610	1-3/16 - 12UN-2B	0 531 112 640	—
		Butyl		0 531 112 611		0 531 112 641	—
		Buna N		0 531 112 612*		0 531 112 642*	—
		Viton		0 531 112 613		0 531 112 643	—
		Buna N Lo-Temp		0 531 112 615		0 531 112 645	—
1	3000	Buna N	1-1/4" NPT	0 531 113 610	1-5/8 - 12UN-2B	0 531 113 640	—
		Butyl		0 531 113 611		0 531 113 641	—
		Buna N		0 531 113 612*		0 531 113 642*	—
		Viton		0 531 113 613		0 531 113 643	—
		Buna N Lo-Temp		0 531 113 615		0 531 113 645	—
2-1/2	3000	Buna N	2" NPT	0 531 114 610	1-7/8 - 12UN-2B	0 531 114 640	9 530 230 110
		Butyl		0 531 114 611		0 531 114 641	9 530 230 111
		Buna N		0 531 114 612*		0 531 114 642*	9 530 230 112*
		Viton		0 531 114 613		0 531 114 643	9 530 230 113
		Buna N Lo-Temp		0 531 114 615		0 531 114 645	9 530 230 114
5	3000	Buna N	2" NPT	0 531 115 610	1-7/8 - 12UN-2B	0 531 115 640	9 530 230 115
		Butyl		0 531 115 611		0 531 115 641	9 530 230 116
		Buna N		0 531 115 612*		0 531 115 642*	9 530 230 117*
		Viton		0 531 115 613		0 531 115 643	9 530 230 118
		Buna N Lo-Temp		0 531 115 615		0 531 115 645	9 530 230 119
10	3000	Buna N	2" NPT	0 531 115 630	1-7/8 - 12UN-2B	0 531 115 650	9 530 230 120
		Butyl		0 531 115 631		0 531 115 651	9 530 230 121
		Buna N		0 531 115 632*		0 531 115 652*	9 530 230 122*
		Viton		0 531 115 633		0 531 115 653	9 530 230 123
		Buna N Lo-Temp		0 531 115 635		0 531 115 655	9 530 230 124
14	3000	Buna N	2" NPT	0 531 116 610	1-7/8 - 12UN-2B	0 531 116 640	9 530 230 125
		Butyl		0 531 116 611		0 531 116 641	9 530 230 126
		Buna N		0 531 116 612*		0 531 116 642*	9 530 230 127*
		Viton		0 531 116 613		0 531 116 643	9 530 230 128
		Buna N Lo-Temp		0 531 116 615		0 531 116 645	9 530 230 129

**Top Repairable**

Size (gal)	Max. Press. (psi)	Material	SAE Threads	Part Number	4 Bolt Flange Code 61 (-32)
2-1/2	3000	Buna N	1-7/8 - 12UN-2B	9 530 230 075	9 530 230 130
		Butyl		9 530 230 076	9 530 230 131
		Buna N*		9 530 230 077*	9 530 230 132*
		Viton		9 530 230 078	9 530 230 133
		Buna N Lo-Temp		9 530 230 079	9 530 230 134
5	3000	Buna N	1-7/8 - 12UN-2B	9 530 230 085	9 530 230 135
		Butyl		9 530 230 086	9 530 230 136
		Buna N*		9 530 230 087*	9 530 230 137*
		Viton		9 530 230 088	9 530 230 138
		Buna N Lo-Temp		9 530 230 089	9 530 230 139
10	3000	Buna N	1-7/8 - 12UN-2B	9 530 230 095	9 530 230 140
		Butyl		9 530 230 096	9 530 230 141
		Buna N*		9 530 230 097*	9 530 230 142*
		Viton		9 530 230 098	9 530 230 143
		Buna N Lo-Temp		9 530 230 099	9 530 230 144
14	3000	Buna N	1-7/8 - 12UN-2B	9 530 230 105	9 530 230 145
		Butyl		9 530 230 106	9 530 230 146
		Buna N*		9 530 230 107*	9 530 230 147*
		Viton		9 530 230 108	9 530 230 148
		Buna N Lo-Temp		9 530 230 109	9 530 230 149

\* Phenolic coated shells for water systems. Consult factory for lead time and availability.

### TUV Approval 5000 psi

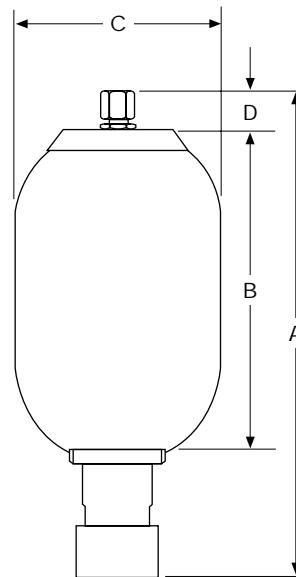
The governing technical inspection organization in Germany is the TUV (Technischer Überwachungsverein). The design, manufacturing and testing of accumulators is monitored and approved by this organization.

Following is a partial listing of German-produced TUV rated accumulators.



### Dimensional Data

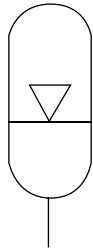
DIMENSIONS (inches)					
Size (gal)	A	B	C	D	Wt. (lbs)
1/4	11.4	7.7	4.5	1.7	11
1	16.2	11.1	6.6	1.7	26
2-1/2	22.9	16.1	8.8	1.7	62
5	33.3	26.5	8.8	1.7	128
10	55.1	48.5	8.8	1.7	198
14	74.8	68.6	8.8	1.7	264



### How to Order

Size (gal)	Max. Press. (psi)	Bladder Material	Oil Port Connection	Part No.
1/4	5000	Buna N	M30 x 1.5	0 531 012 700
1	5000	Buna N	M40 x 1.5	0 531 013 700
2-1/2	5000	Buna N	M50 x 1.5	0 531 014 722
5	5000	Buna N	M50 x 1.5	0 531 015 761
10	5000	Buna N	M50 x 1.5	0 531 015 760
14	5000	Buna N	M50 x 1.5	0 531 016 722

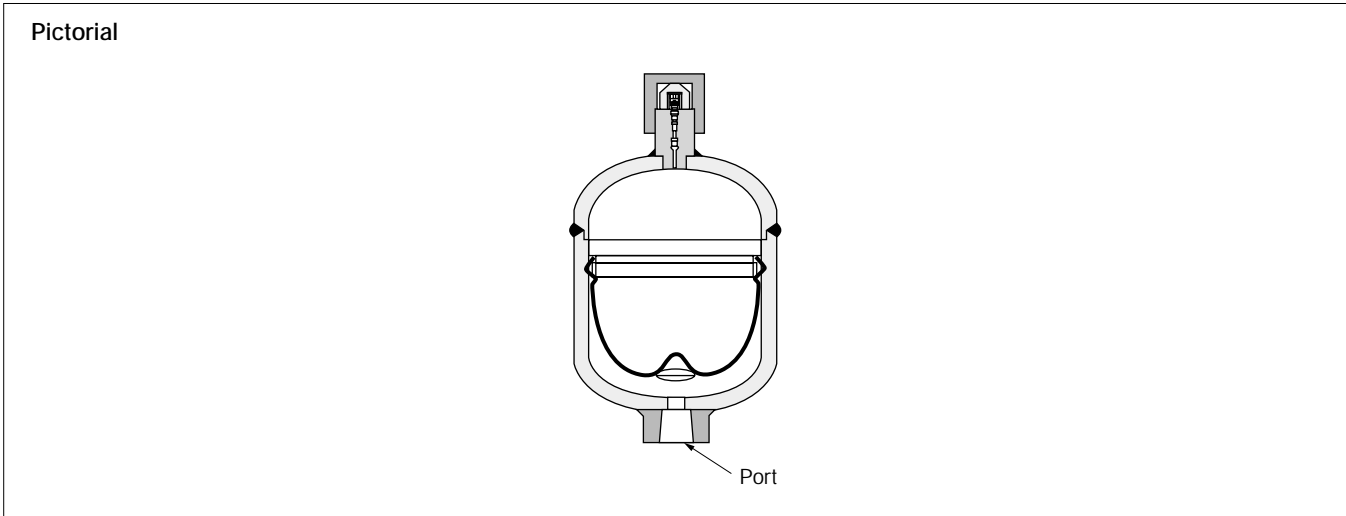
Diaphragm Type



Specifications	
Flow Rates (max.)	
Size (cu. in.)	GPM
4.5	2.5
10	2.5
21	10
30	10
43	10
85	10
122	15.85
170	15.85

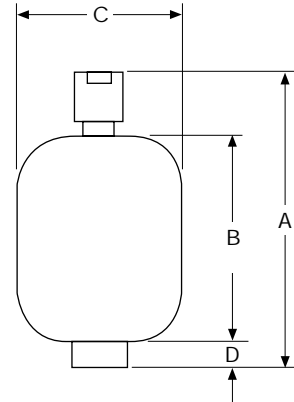
Recommended Diaphragm Material		
Fluids	Material	Temperature Range
Mineral oils	Buna N	+5 °F to +180 °F (-15 °C to +80 °C)
Mineral oils	Lo-Temp Buna N	-40 °F to +180 °F (-40 °C to +80 °C)
Chlorinated hydrocarbons	Viton	+5 °F to +212 °F (-15 °C to +100 °C)
Brake fluids Phosphate esthers	Butyl	-40 °F to +180 °F (-15 °C to +80 °C)

For other fluids, please contact factory.

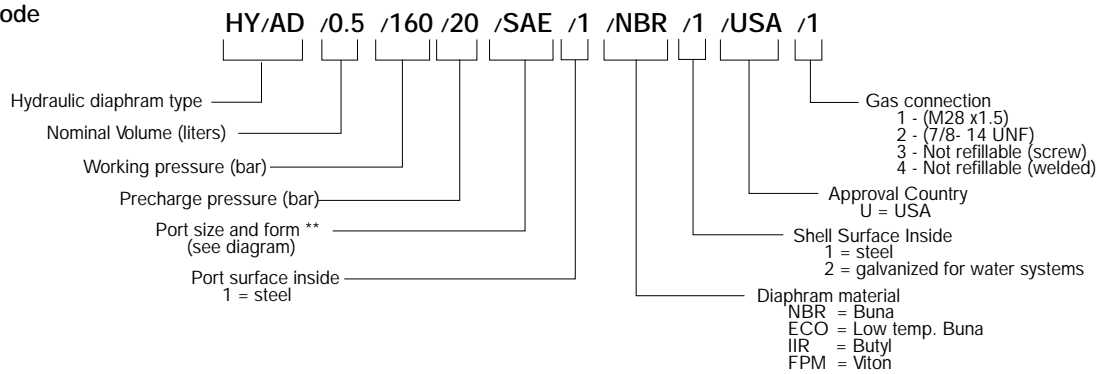


Dimensional Data

DIMENSIONS (inches)						
Nominal Size (cu. in.)	Effective Gas	A	B	C	D	Wt. (lbs)
4.5	4.5	3.86	2.36	2.52	0.63	1.43
10	9.2	5.43	3.03	2.95	0.63	2.20
21	19.5	6.02	3.62	3.62	0.63	3.30
30	29.2	5.63	4.13	4.05	0.63	3.31
30	29.2	5.75	4.25	4.17	0.63	4.41
43	45.8	7.20	4.80	4.76	0.63	6.60
43	45.8	7.44	5.04	5.00	0.63	7.04
85	88.5	8.70	6.06	6.10	0.87	13.00
122	115.9	10.78	8.16	6.10	0.87	15.40
170	164.8	11.50	8.86	6.85	0.87	21.30



Model Code

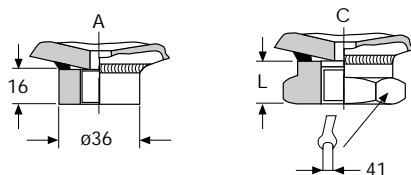


How to Order

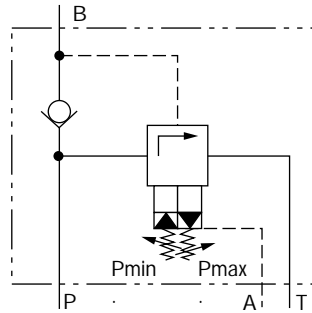
Size	Max. Press. (psi)	Material	Port Size & Form	Part Number
4.5 in <sup>3</sup> (0.075L)	3625	Buna N	9/16 - 18 UNF-2B S	0 531 610 632
10 in <sup>3</sup> (0.16L)	3625	Buna N	9/16 - 18 UNF-2B S	0 531 600 611
21 in <sup>3</sup> (0.35L)	2320	Buna N	3/4 - 16 UNF-2B A	0 531 601 549
		Viton		0 531 601 567
30 in <sup>3</sup> (0.50L)	2320 3000	Buna N	3/4 - 16 UNF-2B A	0 531 611 527
		Buna N		0 531 611 603
43 in <sup>3</sup> (0.70L)	2610 3000	Buna N	3/4 - 16 UNF-2B A	0 531 602 560
		Buna N		0 531 602 588
85 in <sup>3</sup> (1.4L)	3000	Buna N	3/4 - 16 UNF-2B C	0 531 603 501
122 in <sup>3</sup> (2.0L)	3000	Buna N	3/4 - 16 UNF-2B C	0 531 623 500
170 in <sup>3</sup> (2.8L)	3000	Buna N	3/4 - 16 UNF-2B C	0 531 613 503
		Butyl		0 531 613 505
		ECO		0 531 613 504

Note: Port form "S" is a special similar to type "A," all parts listed above have 7/8 - 14 UNF gas connections.

\*\* Port Forms

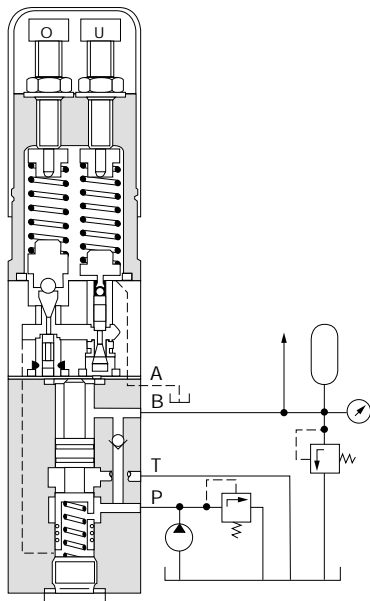


## Differential Unloading Valve WITH INTEGRAL CHECK



Specifications			
Valve Function	Unloading valve		
Mounting	Not restricted DO3 subplate ISO 6263		
Fluid	Mineral-oil or fluid HFA / B / C / D		
Viscosity	60 . . . 2500 SUS (10 . . . 500 cst)		
Fluid-temperature	-13 to 176 °F (-20 to 80 °C)		
Filtration	Contamination class 10, according to NAS 1638 can be realized with filter $\beta = 75$		
Seals	Viton		
Flow rating	See "Performance Characteristics"		
Drain	Port "A" 30 psi (2 bar) max.		
Leakage cu.in./min (cc/min)		1500 psi (100 bar)	3300psi (210 bar)
	Charging	15.25 (250)	30.5 (500)
	Unloading	0.9 (15)	2.5 (40)

### Pictorial



### Adjustment

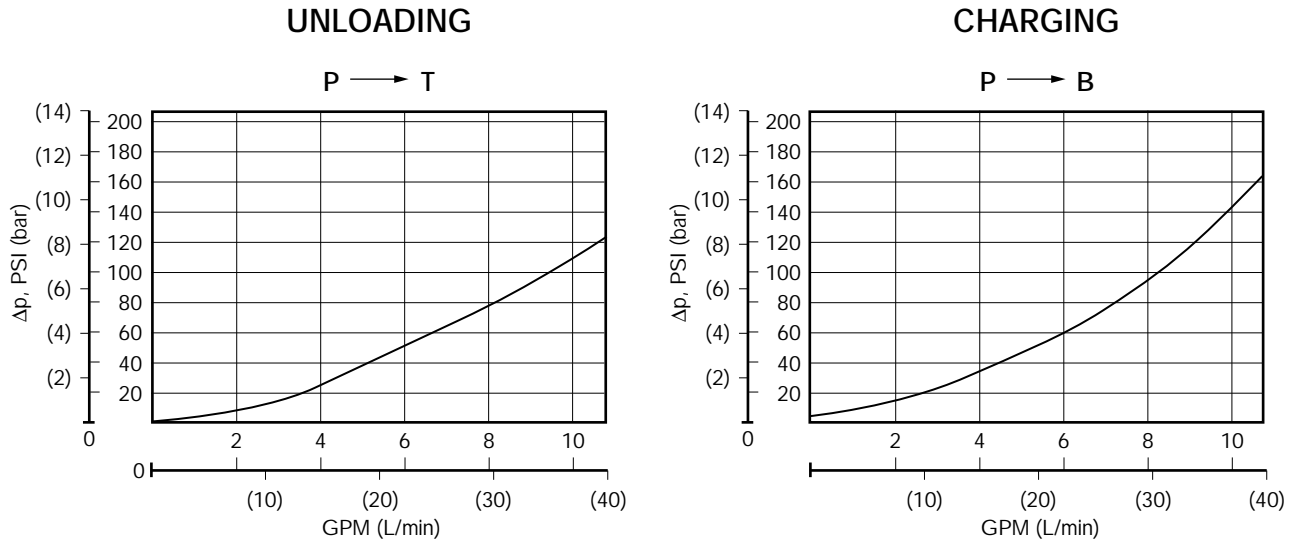
#### 1. $p_{max}$ by setscrew O

Pump on, Blocked circuit. Turn screw U counterclockwise. Adjust screw O while observing pressure gauge.

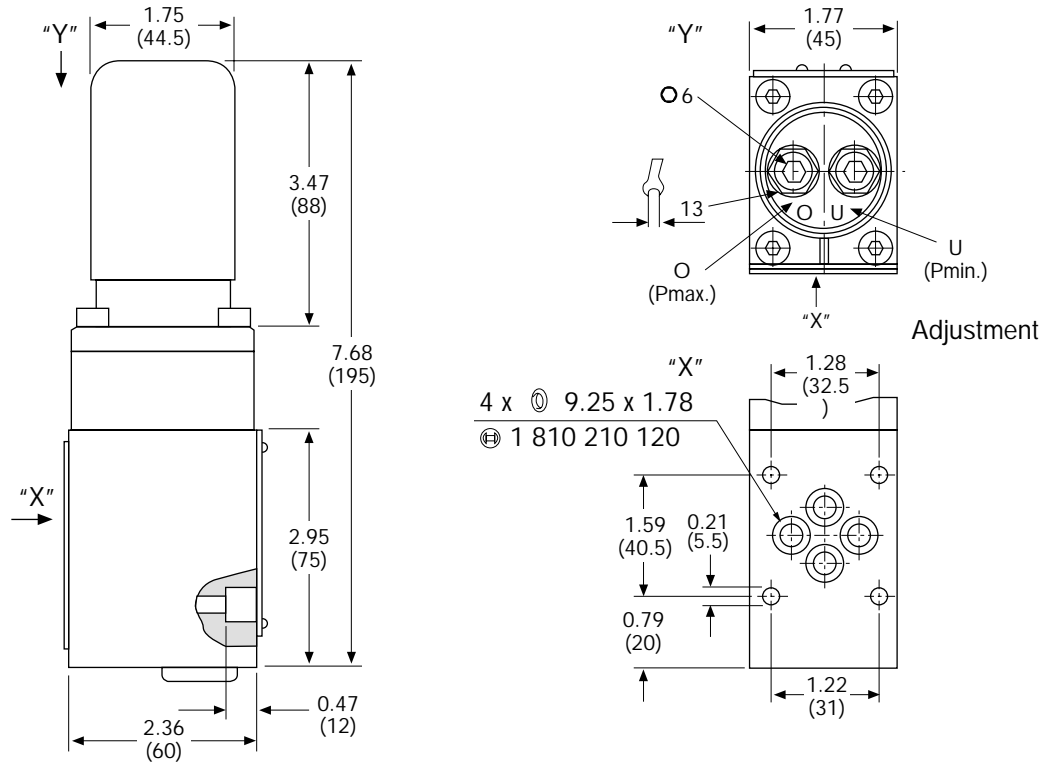
#### 2. $p_{min}$ by setscrew U

Discharge accumulator slowly. Adjust screw U while observing pressure gauge.

Performance Characteristics (typical)



Dimensional Data: dimensions in inches (millimeters)



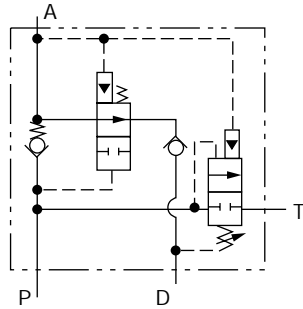
How to Order

	Pressure	Differential	Weight	Part No.
Unloading Valve	360...1500 psi	70...150 psi	6.6lb	0 811 106 032
	870...3045 psi	150...215 psi		0 811 106 033
	2175...4600 psi	215...360 psi		0 811 106 034

**Combination Accumulator  
Discharge/Differential  
Unloading Valve**

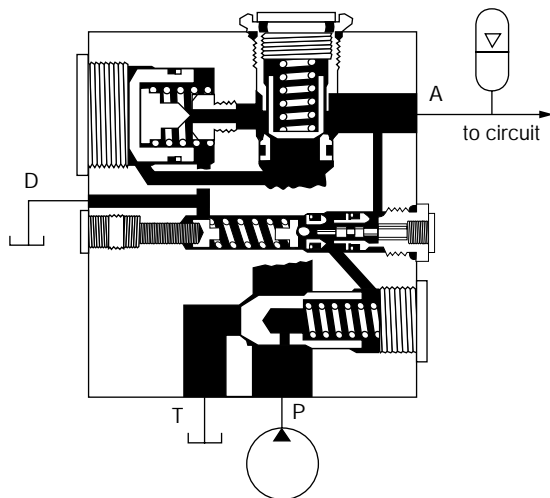
WITH INTEGRAL CHECK

50 GPM 3000PSI



Specifications	
Valve Function	Accumulator Unloading and Discharge
Mounting	Inline not restricted
Fluid	Mineral-oil or fluid HFA / B / C / D
Viscosity	60 . . . 2500 SUS (10 . . . 500 cst)
Fluid-temperature	-13 to +176 °F (-25 to +80 °C)
Filtration	Contamination class 10, according to NAS 1638 can be realized with filter $\beta = 75$
Seals	Viton
Pressure differential (discharge valve)	140:1
Pilot pressure (discharge valve)	65 psi (4.5 bar)
Pressure differential (unloading valve)	25% of set pressure
Adjustment range	250 to 3000 psi (17.2 to 207 bar)
Flow rating	2-50 GPM (8 - 190 l/min)
Repeatability	Plus or minus 25 psi (1.7 bar)
Drain	Drain must be connected directly to tank. Back pressure to be less than 5% of setting.

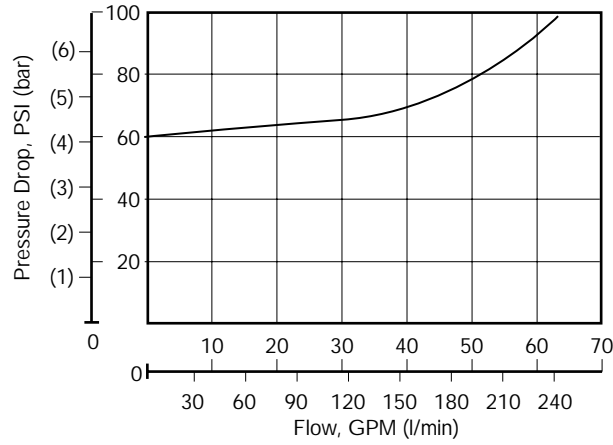
**Pictorial**



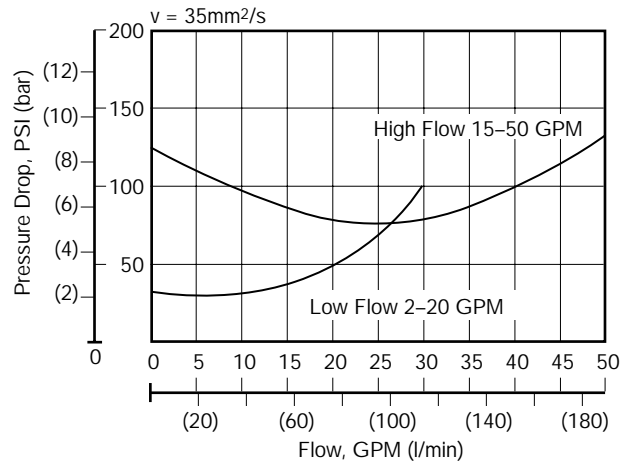
Designed for use in an accumulator circuit powered by a non-pressure compensated pump. This valve incorporates a check valve to prevent reverse flow. A differential unloading valve to unload the pump once the accumulator has been charged, and an accumulator discharge valve to automatically discharge the pressurized fluid in the accumulator upon loss of pump pressure.

Performance Characteristics (typical)

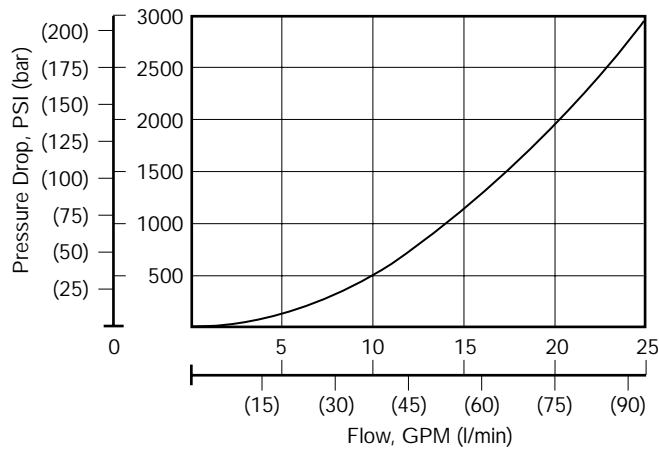
**PRESSURE DROP ACROSS CHECK VALVE**



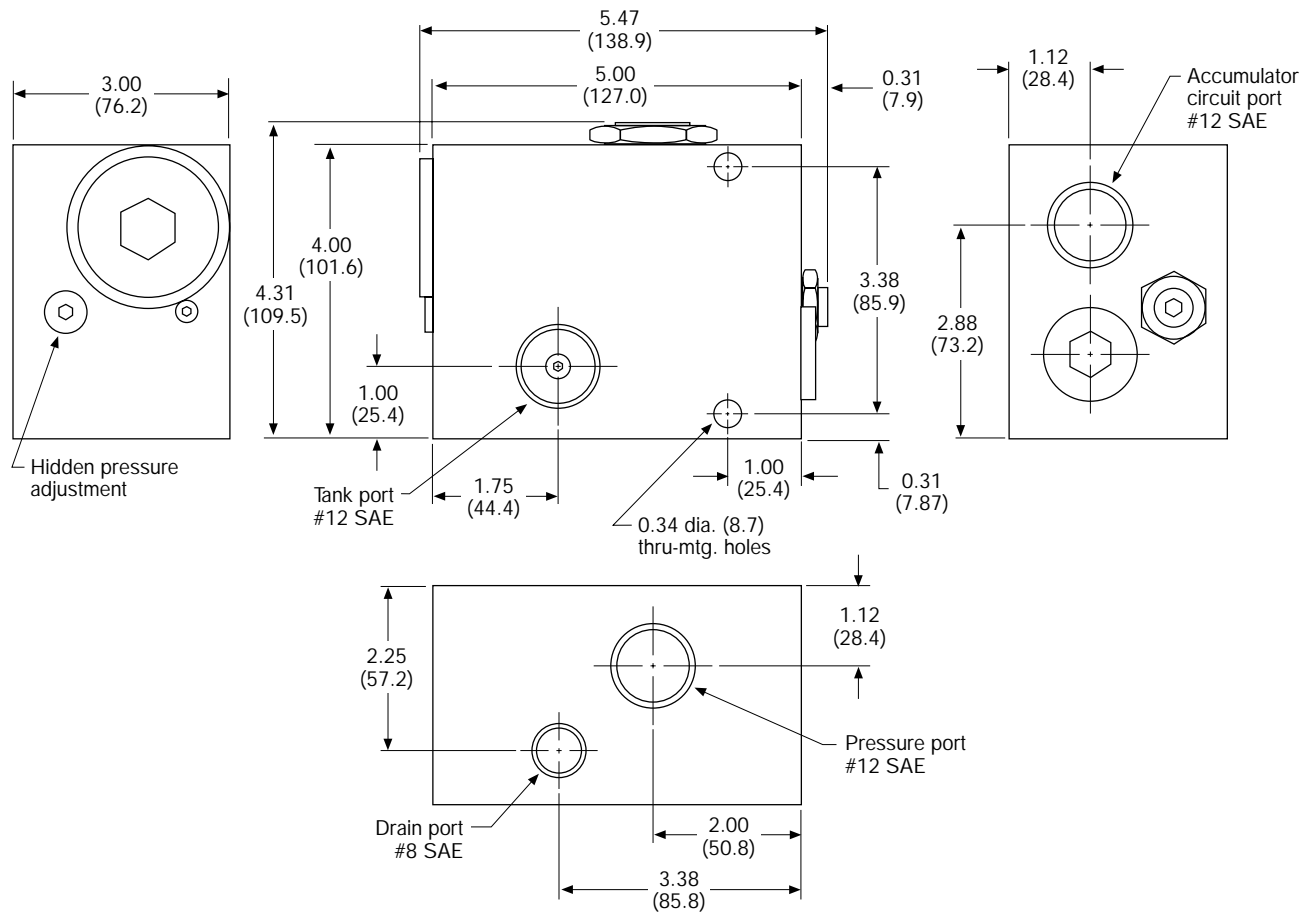
**PRESSURE DROP WHEN UNLOADING**



**DISCHARGE RATE**



Dimensional Data: dimensions in inches (millimeters)



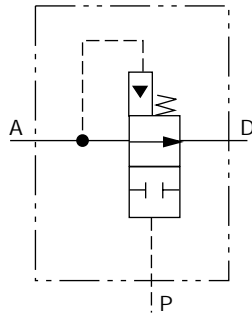
How to Order

**AD - U1 - 54 - LF - 10**

- 1 - 2...20 GPM (7.6...75.7 L/min)
- 3 - 15...50 GPM (56.8...189.3 L/min)
- 54 -- #12 SAE ports
- L - 250...1000 PSI (17.2...68.8 bar)
- M - 750...2000 PSI (51.6...137.6 bar)
- H - 1500...3000 PSI (103.2...206.4 bar)

Model Code	Part Number	Model Code	Part Number
AD-U1-54-LF-10	982383	AD-U3-54-LF-10	987626
AD-U1-54-MF-10	982384	AD-U3-54-MF-10	982381
AD-U1-54-HF-10	982385		

# Accumulator Discharge Valve 3000PSI



Specifications	
Valve Function	Accumulator Discharge
Mounting	Inline not restricted
Fluid	Mineral-oil or fluid HFA / B / C / D
Viscosity	60. . . 2500 SUS (10. . . 500 cst)
Fluid-temperature	-13 to 176 °F (-25 to 80 °C)
Filtration	Contamination class 10, according to NAS 1638 can be realized with filter $\beta = 75$
Seals	Viton
Pressure differential (discharge valve)	140:1
Pilot pressure (discharge valve)	65 psi (4.5 bar)
Flow rating	See "Performance Characteristics"
Drain	Drain must be connected directly to tank. Back pressure to be less than 10% of setting.

**Pictorial**

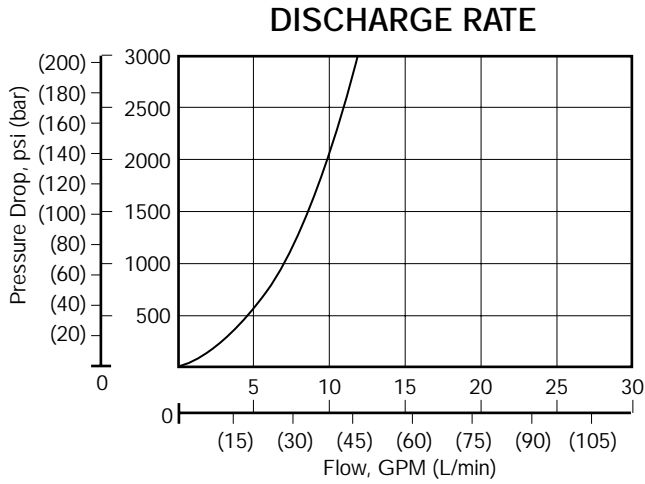
Used in circuits powered by non-pressure compensated pumps, the accumulator discharge valve is designed to automatically discharge the pressurized fluid from the accumulator circuit upon pump shut down. Basically, it is a pilot operated, poppet type 2-way valve.

This "normally open" valve is held in the closed position by the pilot pressure from the outlet port of the pump. The pump pilot pressure is directed against the large piston. Pressure in the accumulator portion of the circuit is sensed directly on the smaller opposing piston.

With a 140:1 area ratio between the two pistons, the valve will remain in the closed position as long as the pump to accumulator pressure ratio is maintained at or above a level that is inversely proportional to the area ratio. When the pump pilot pressure drops below that level, the valve is piloted open by the full pressure of the accumulator circuit and the accumulator is discharged directly to tank.

Typical Accumulator Circuit

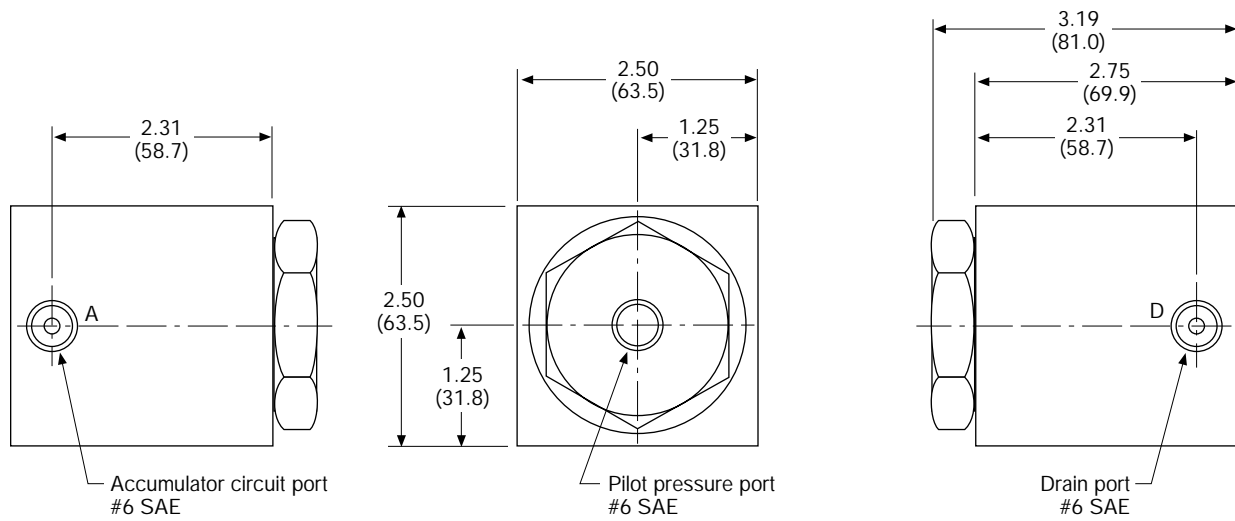
Performance Characteristics (typical)



Leakage at 3000 psi: 10 drops per minute.

Data plotted at oil temperature of 120°F (48.8°C), using oil with 200 SUS (43cSt) viscosity at 100°F (37.7°C).

Dimensional Data: dimensions in inches (millimeters)



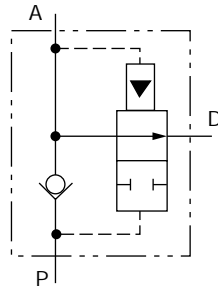
NOTE:  
UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE NOMINAL

How to Order

AD - P1 - 51 - F - 10 | 9 8 2 3 7 8

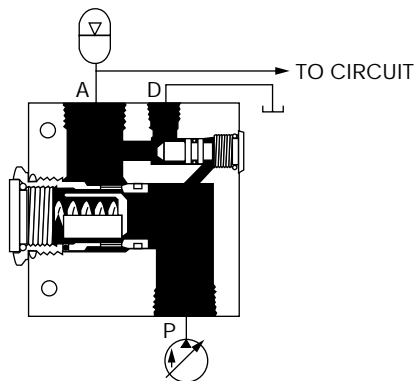
Model Code	Part Number
AD-P1-51-F-10	982378

**Accumulator Discharge Valve  
WITH INTEGRAL CHECK  
3000PSI**



Specifications	
Valve Function	Accumulator Discharge with check
Mounting	Inline not restricted
Fluid	Mineral-oil or fluid HFA / B / C / D
Viscosity	60. . . 2500 SUS (10. . . 500 cst)
Fluid-temperature	-13 to 176 °F (-25 to 80 °C)
Filtration	Contamination class 10, according to NAS 1638 can be realized with filter $\beta = 75$
Seals	Viton
Pressure differential (discharge valve)	4:1
Flow rating	See "Performance Characteristics"

**Pictorial**



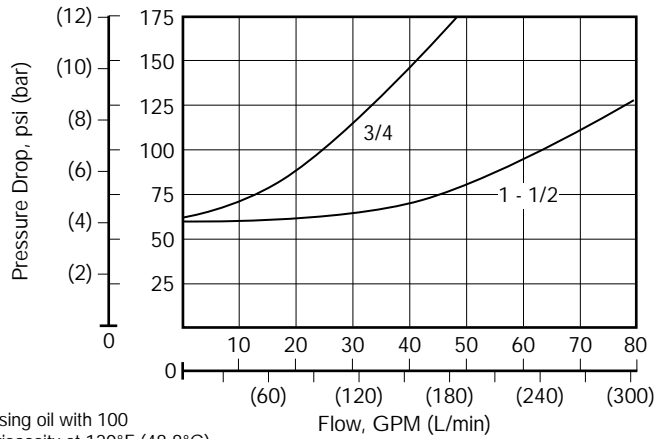
The accumulator discharge valve with integral check is designed to be utilized in accumulator circuits powered by pressure compensated pumps. This valve will automatically discharge the pressurized fluid in the accumulator upon pump shutdown. Basically, it is a pilot operated, poppet type 2-way with an integral check.

Pressurized fluid from the pump is ported into the valve at Port "P". Port "A" is connected to the accumulator circuit; Port "D" is connected to drain or tank. Fluid from the upstream side of the check is directed to the large area of the discharge poppet while fluid from the downstream side of the check is directed against the small area of the poppet. With a 4:1 area ratio between the two ends of the poppet, the valve is piloted closed and will remain closed as long as the pump to accumulator pressure ratio remains at or above a level inversely proportional to the area ratio. When the pressure ratio drops below that level, such as on pump shutdown, the discharge poppet is piloted open, discharging the accumulator directly to tank.

Performance Characteristics (typical)

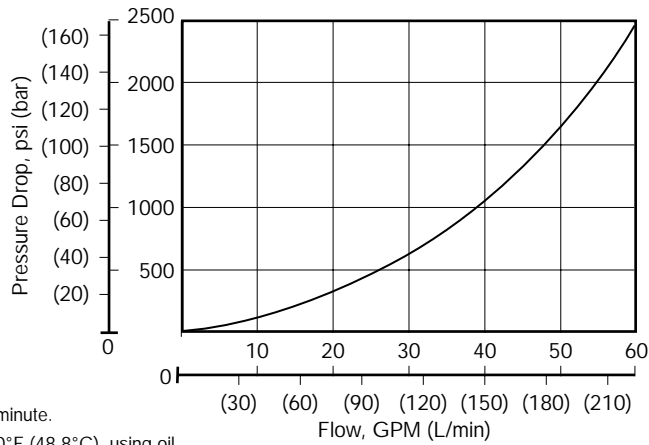
**PRESSURE DROP**

\*Pressure Drop vs Flow



\* ACROSS CHECK Data plotted using oil with 100 SUS (21cSt) viscosity at 120°F (48.8°C)

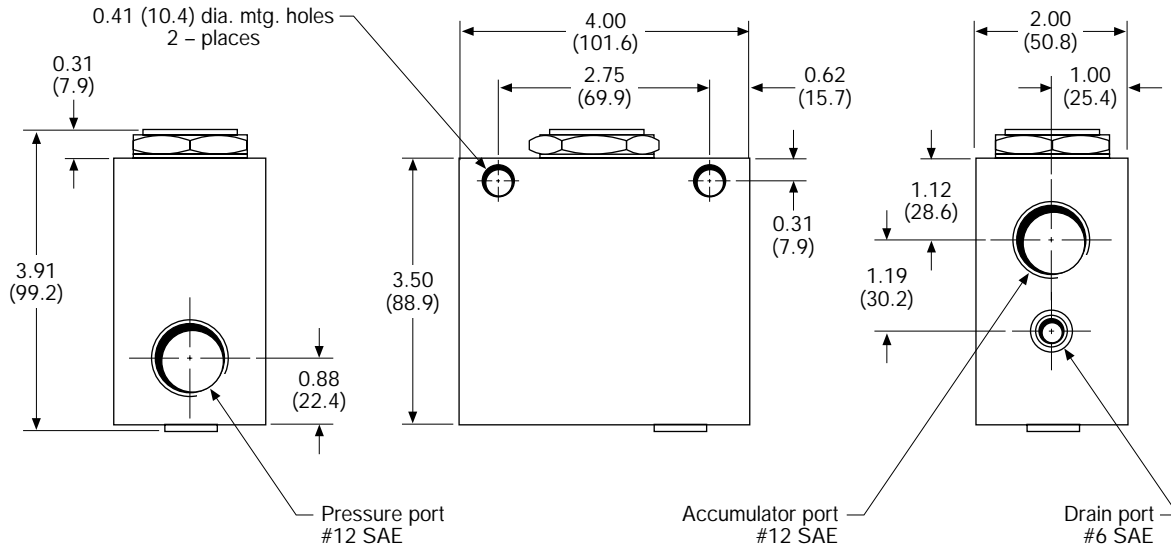
**DISCHARGE RATE**



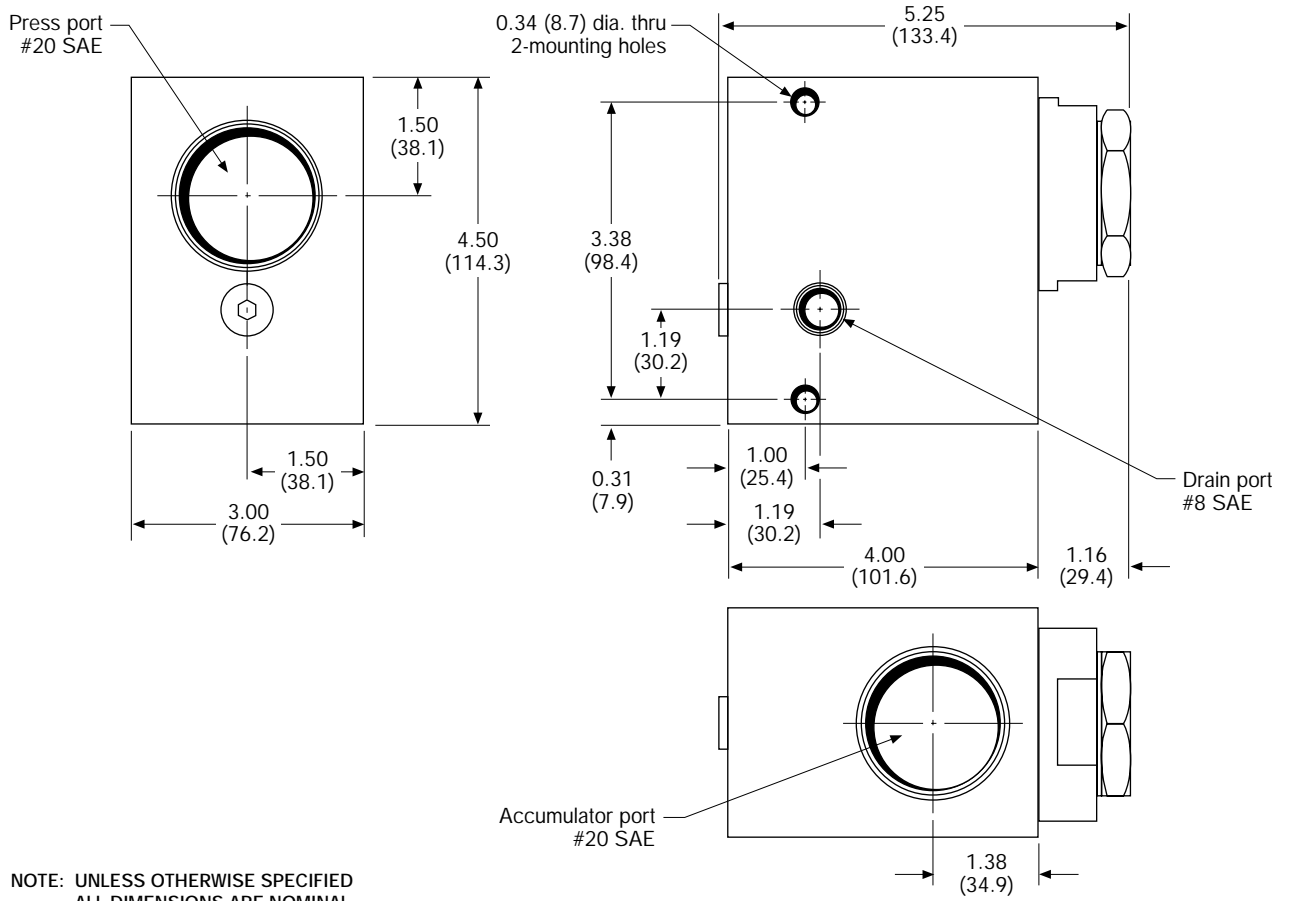
Leakage at 3000 psi : 10 drops per minute.

Data plotted at oil temperature of 120°F (48.8°C), using oil with 200 SUS (43cSt) viscosity at 100°F (37.7°C).

**Dimensional Data C-3 Valve: dimensions in inches (millimeters)**

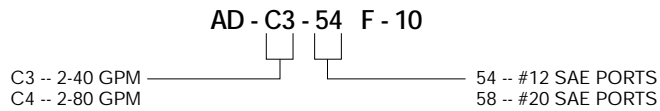


Dimensional Data C-4 Valve: dimensions in inches (millimeters)



NOTE: UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE NOMINAL

How to Order

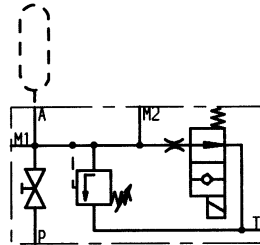


Model Code	Part Number
AD-C3-54F-10	982285
AD-C4-58F-10	982379

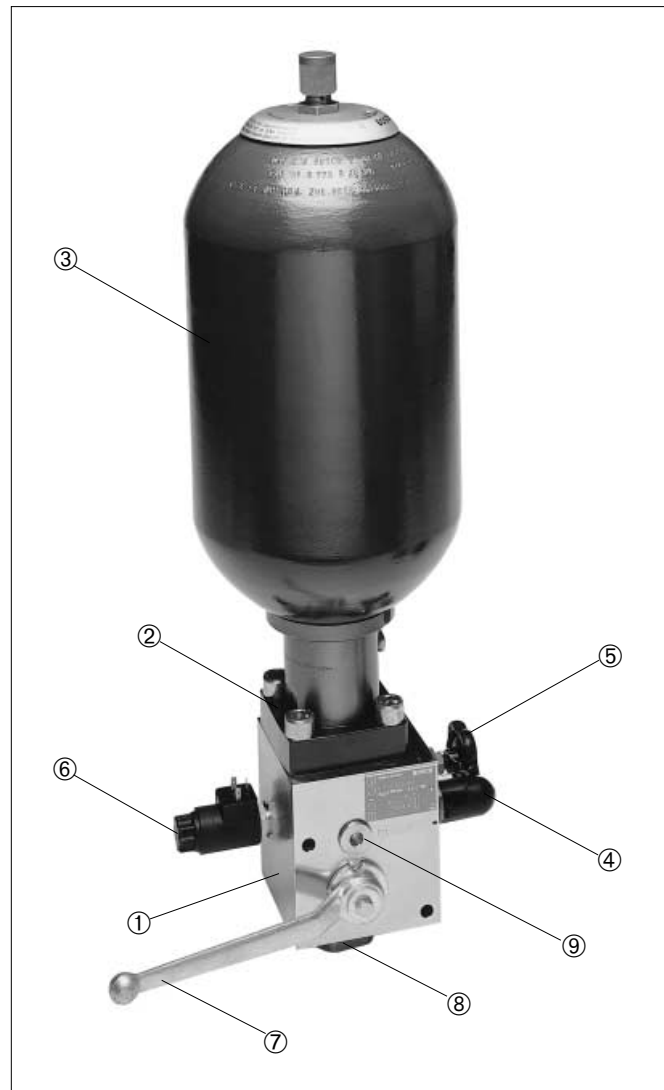
## Safety and shut-off blocks

NG 20 Typ VAW 20

NG 32 Typ VAW 32



- ① Block
- ② Adapter fitting, Flange
- ③ Accumulator
- ④ Pressure-relief valve, sealed with lead
- ⑤ Discharge, manual
- ⑥ Discharge valve, electric (optional)
- ⑦ Shut-off valve
- ⑧ P-port
- ⑨ Gauge port



### Application

The Bosch Rexroth safety and shut-off block is a hydraulic element for the purpose of shutting off and discharging, preferably for use with hydro-pneumatic bladder-type accumulators.

The block incorporates safety and shut-off devices as specified to DIN 24 552 of the Pressure Vessels Decree and the Technical Regulations for Pressure Vessels (TRB 403 and 404).

An optional extra electrically operated 2-way directional control valve (open without flow) enables the accumulator or consuming device – and therefore the hydraulic system – to be automatically relieved of pressure. This occurs when the safety elements are needed or in the event of shutdown, "Emergency stop function."

The manifold and accumulator are connected via an adapter fitting or flange.

The safety and shut-off block features the following connections:

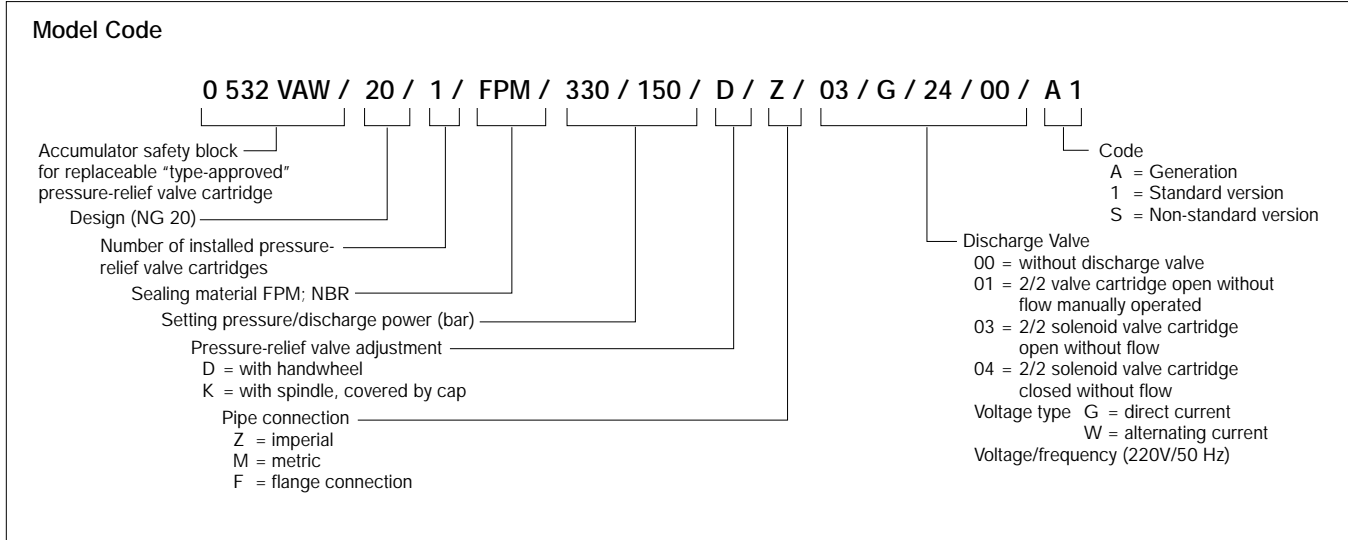
- A – Accumulator connection
- P – Pipeline or flange connection (pump)
- T – Tank connection
- M 1 – Test gauge connection
- M 2 – Pressure gauge connection

### Approval

The pressure-relief valve block is tested and sealed by TÜV representatives. The valve is marked with the code and a serial number. Certification of the pressure setting is supplied with the valve.

### Important:

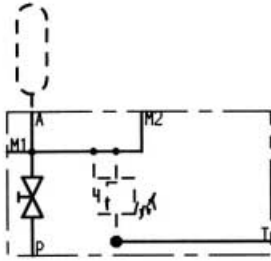
Keep the certificate in a safe place.



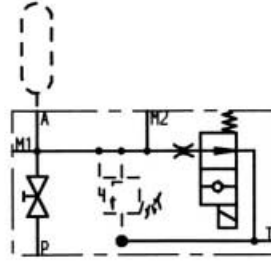
Specifications		
Construction	Safety valve	Damped poppet valve
	Shut-off valve	Ball valve
	Electr. discharge	Poppet valve
Type of connection	Pipe connection/flange	
Installation position	Port A or electrical discharge above	
Ambient temperature	+5 ... +176 °F (-15 ... +80 °C) electrical discharge +104 °F (40 °C)	
Max. working pressure	5076 psi (350 bar)	
Discharge flow rate G [l/min] and p <sub>Nom</sub> bar	see tables, pages 26 ... 28	
Pressure fluid F	Mineral oils as per DIN/ISO and flame-retardant pressure fluids as per VDMA 24 317/24 320	
Working temperature range	+5 ... 176 °F (-15 ... +80 °C)	
Viscosity range	2.59 ... 81.87 SUS (12 ... 380 mm <sup>2</sup> /s)	
Δ p-Q characteristics	see page 29	
Electrical discharge	U = 24 V/DC 1,04 A; 105 DC (for 115 V/60 Hz, AC rectified) p <sub>20</sub> = 26 W, 100 % c.d.f. IP 65, connector DIN 43 650	

Accumulator safety and shut-off block NG 20

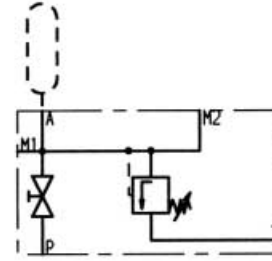
Block for replaceable certified type pressure-relief valve cartridge



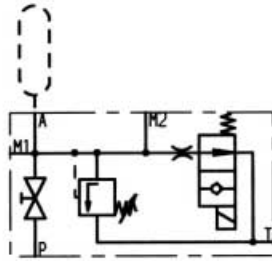
Symbol 1



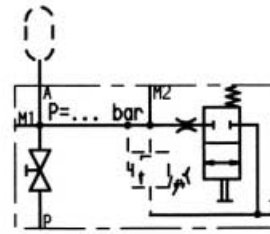
Symbol 2



Symbol 3



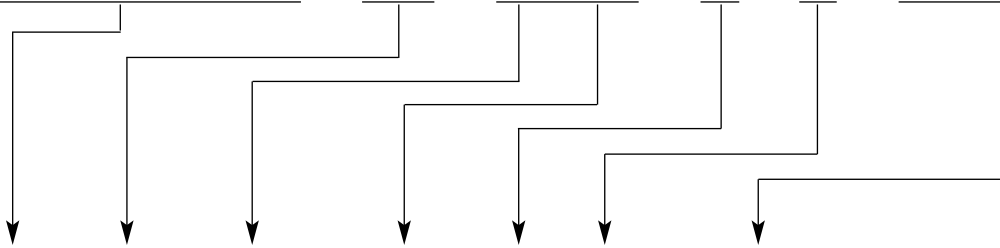
Symbol 4



Symbol 8

How to Order

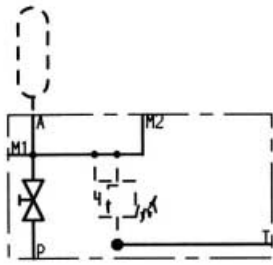
0 532 VAW / 20 / 1 / FPM / 330 / 150 / D / Z / 03 / G / 24 / 00 / A 1



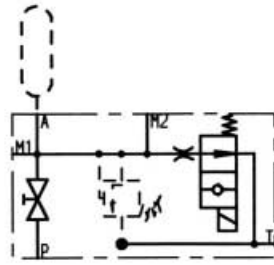
Symbol	FPM NBR	p psi [bar]	G GPM [l/min]			V/Hz	lbs. [kg]	Part Number	
1	FPM	—	—	D	Z	—	11.24 (5.1)	0 532 015 120	
2		—	—			24/00	12.34 (5.6)	0 532 015 121	
8		—	—			—	manual	12.56 (5.7)	0 532 015 139
3		1015 ( 70)	13.21 ( 50)			—	—	12.12 (5.5)	0 532 015 123
4		1015 ( 70)	13.21 ( 50)			24/00	—	13.22 (6.0)	0 532 015 122
3		1450 (100)	26.42 (100)			—	—	12.12 (5.5)	0 532 015 125
4		1450 (100)	26.42 (100)			24/00	—	13.22 (6.0)	0 532 015 124
3		2031 (140)	26.42 (100)			—	—	12.12 (5.5)	0 532 015 127
3		2321 (160)	26.42 (100)			—	—	12.12 (5.5)	0 532 015 129
4		2321 (160)	26.42 (100)			24/00	—	13.22 (6.0)	0 532 015 126
3		3060 (211)	26.42 (100)			—	—	12.12 (5.5)	0 532 015 131
4		3060 (211)	26.42 (100)			24/00	—	13.22 (6.0)	0 532 015 128
3		3626 (250)	34.34 (130)			—	—	12.12 (5.5)	0 532 015 133
4		3626 (250)	34.34 (130)			24/00	—	13.22 (6.0)	0 532 015 130
3		4061 (280)	34.34 (130)			—	—	12.12 (5.5)	0 532 015 137
4		4061 (280)	34.34 (130)			24/00	—	13.22 (6.0)	0 532 015 134
3		4786 (330)	39.63 (150)			—	—	12.12 (5.5)	0 532 015 135
4		4786 (330)	39.63 (150)			24/00	—	13.22 (6.0)	0 532 015 132

Ports A: M 33x2 P: G1 T: G 1/2 M 1: G 1/2 plugged M 2: G 1/4 plugged

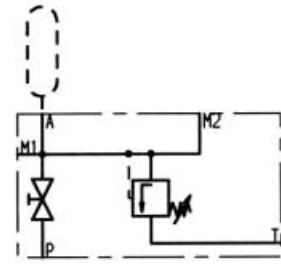
**Accumulator safety and shut-off block NG 32**  
 Block for replaceable certified type pressure-relief valve cartridge



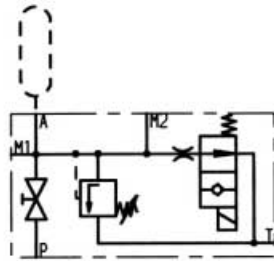
Symbol 1



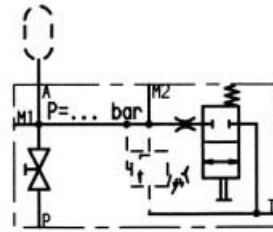
Symbol 2



Symbol 3



Symbol 4



Symbol 8

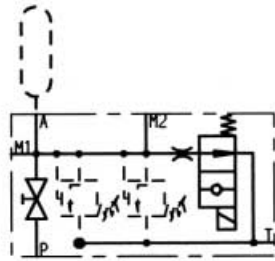
**How to Order**

0 532 VAW / 32 / 1 / FPM / 330 / 150 / D / Z / 03 / G / 24 / 00 / A 1

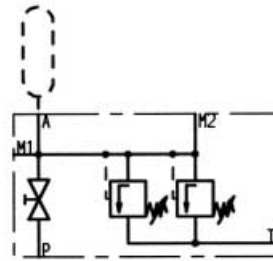
Symbol	FPM NBR	p psi [bar]	G GPM [l/min]			V/Hz	lbs. [kg]	Part Number	
2	FPM	—	—	D	Z	24/00	31.52 (14.3)	0 532 016 050	
1		—	—			—	30.41 (13.8)	0 532 016 051	
8		—	—			manual	31.74 (14.4)	0 532 016 061	
4		2320 (160)	26.42 (100)			24/00	32.40 (14.7)	0 532 016 054	
3		3060 (211)	26.42 (100)			—	31.30 (14.2)	0 532 016 053	
4		3060 (211)	26.42 (100)			24/00	32.40 (14.7)	0 532 016 056	
3		4786 (330)	39.63 (150)			—	31.30 (14.2)	0 532 016 055	
4		4786 (330)	39.63 (150)			24/00	32.40 (14.7)	0 532 016 058	
4		4786 (330)	39.63 (150)			F*	24/00	30.64 (13.9)	0 532 016 060

Ports A: Flange  
 P: G 1 1/2  
 \*P: Flange only for 0 532 016 070 and 0 532 016 072  
 T: G 1  
 M 1: G 1/2 plugged  
 M 2: G 1/4 plugged

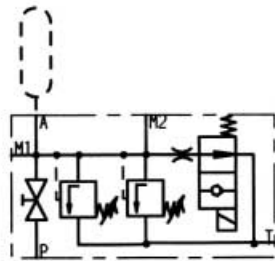
**Accumulator safety and shut-off block NG 32**  
 Block for two replaceable certified type pressure-relief valve cartridges



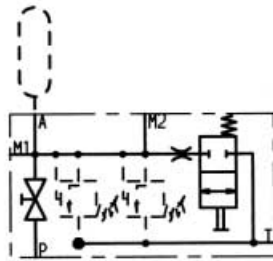
Symbol 5



Symbol 6



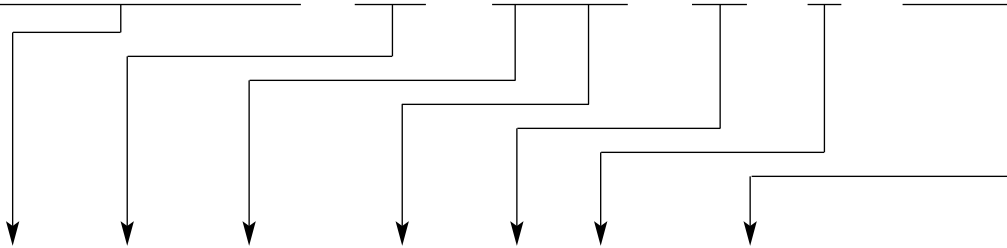
Symbol 7



Symbol 9

**How to Order**

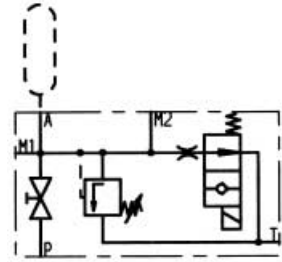
0 532 VAW / 32 / 2 / FPM / 280 / 260 / DK / Z / 03 / G / 24 / 00 / A 1



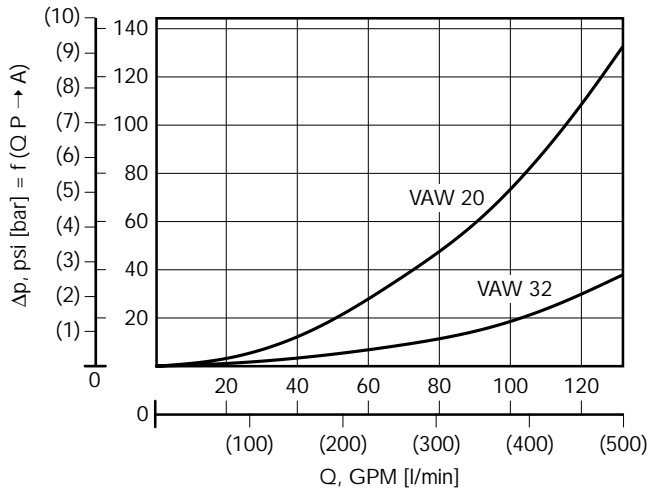
Symbol	FPM NBR	p psi [bar]	G GPM [l/min]		V/Hz	lbs. [kg]	Part Number	
5	FPM	—	—	DK	Z	24/00	21.40 (14.2)	0 532 016 052
9		—	—		Z	manuell	31.52 (14.3)	0 532 016 063
6		4061 (280)	68.68 (260)		Z	—	32.40 (14.7)	0 532 016 057
7		3060 (211)	52.83 (200)		F*	24/00	31.74 (14.4)	0 532 016 070
7		3626 (250)	68.68 (260)		F*	24/00	31.74 (14.4)	0 532 016 072

Ports A: Flange  
 P: G 1-1/2  
 \*P: Flange only for 0 532 016 070 and 0 532 016 072  
 T: G 1  
 M 1: G 1/2 plugged  
 M 2: G 1/4 plugged

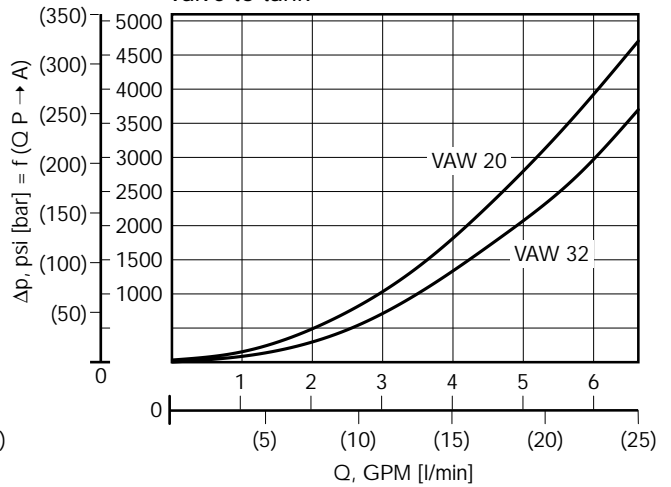
Performance curves



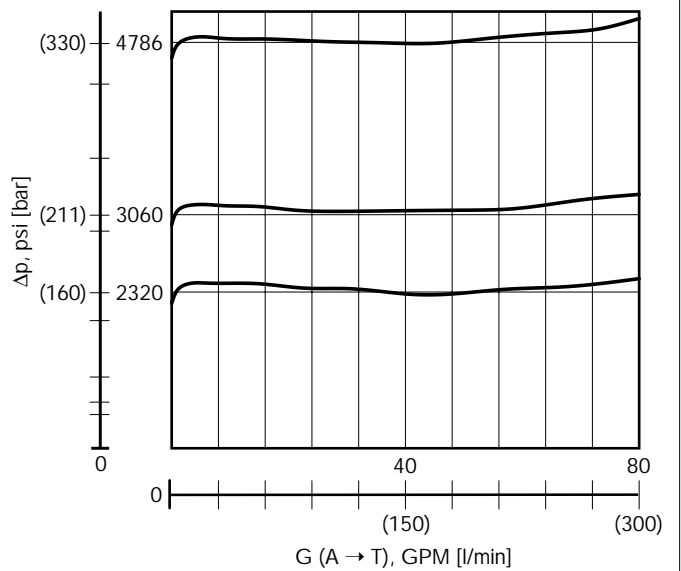
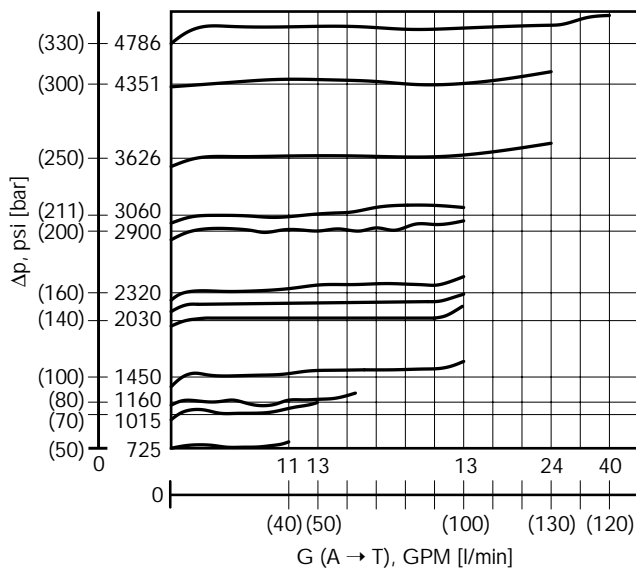
Flow from pump to accumulator



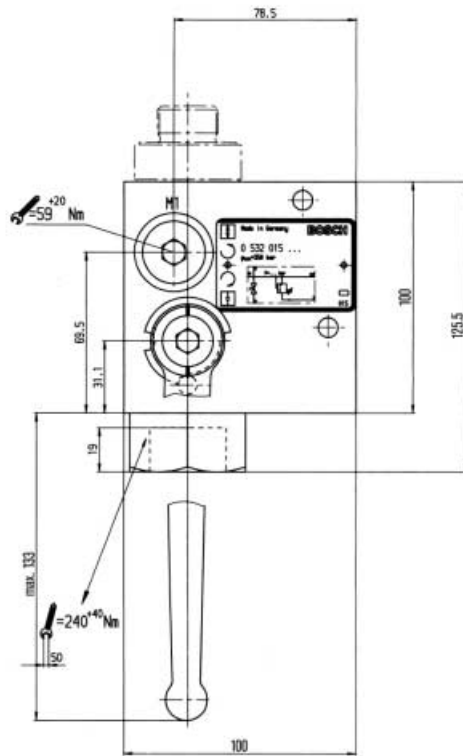
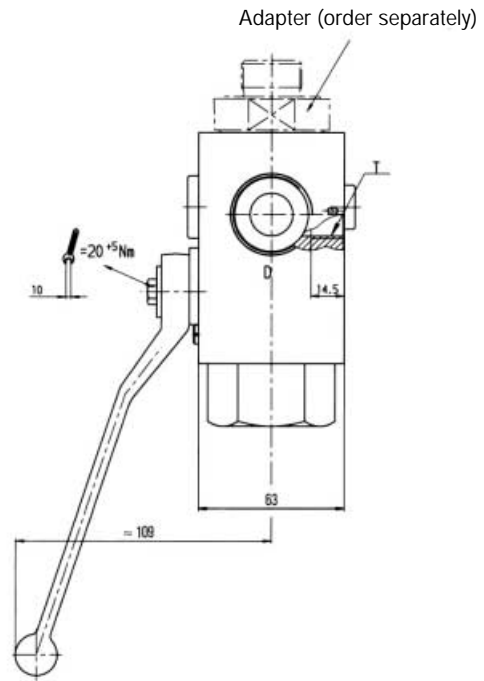
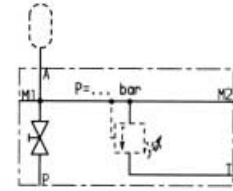
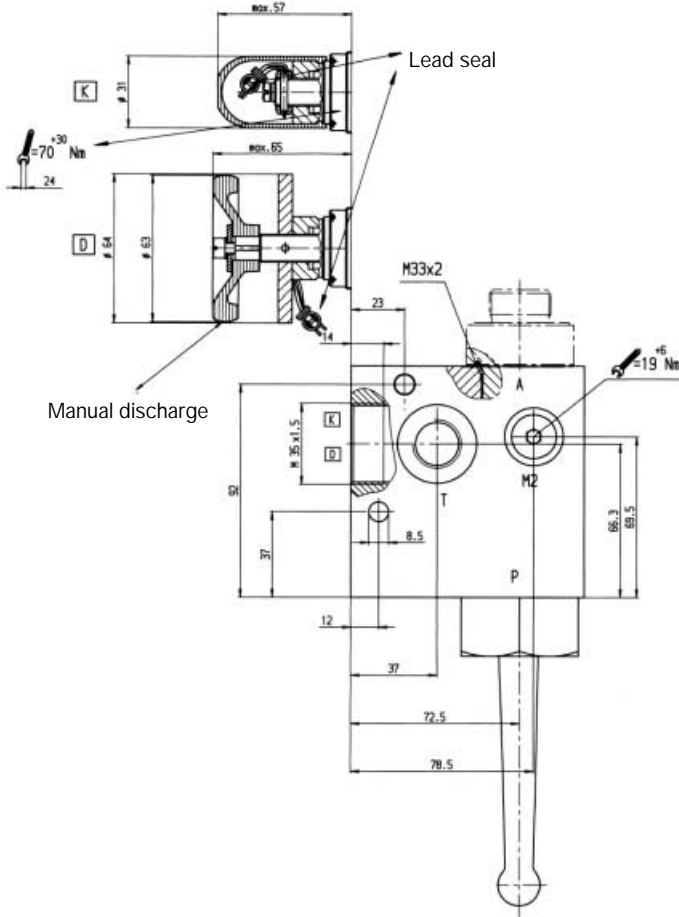
Flow from accumulator via discharge valve to tank



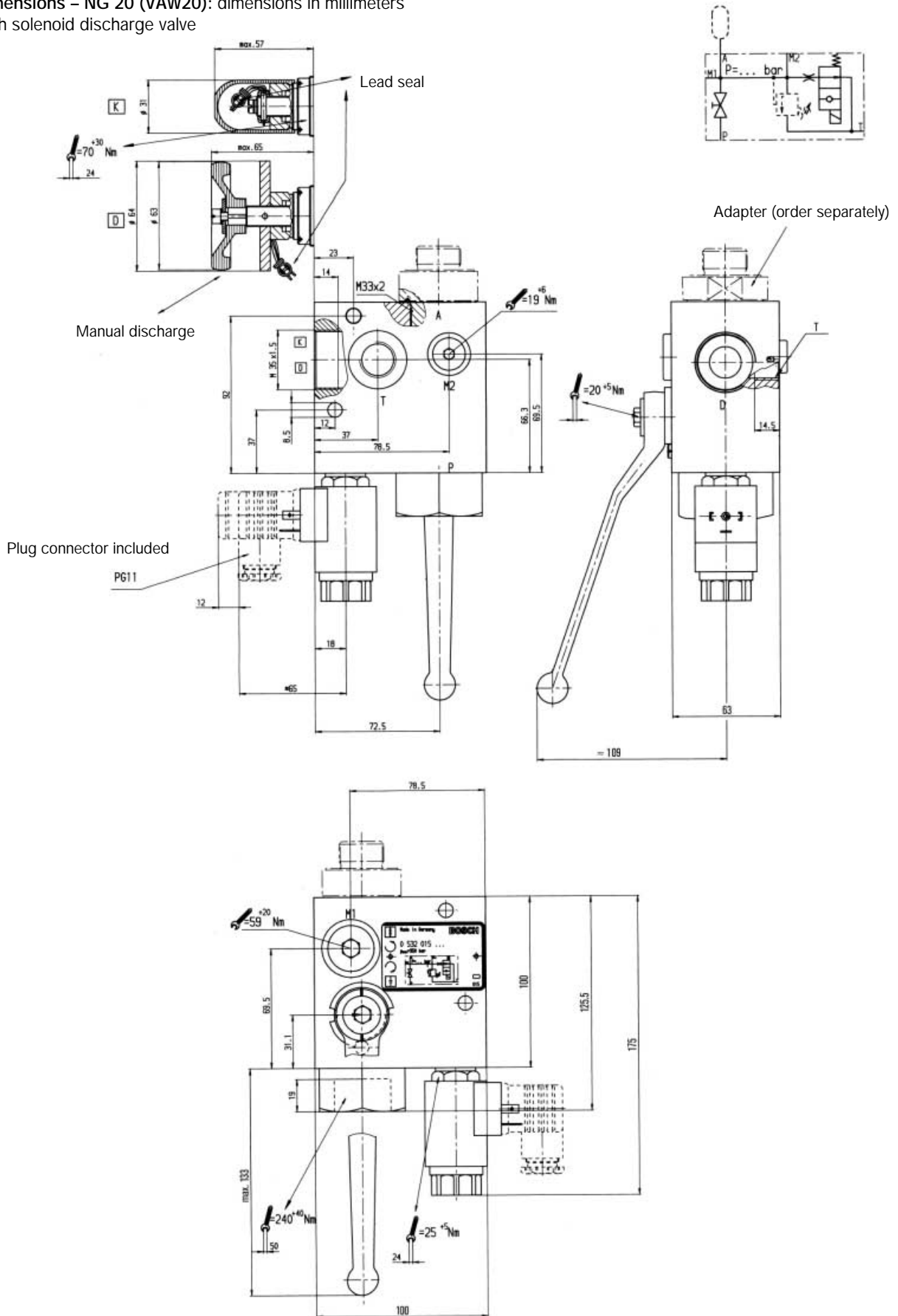
Flow from accumulator via pressure-relief valve to tank



Dimensions – NG 20 (VAW20): dimensions in millimeters  
Without discharge valve



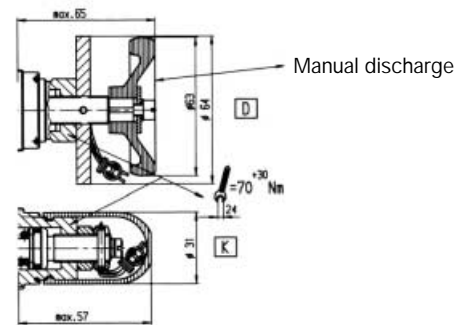
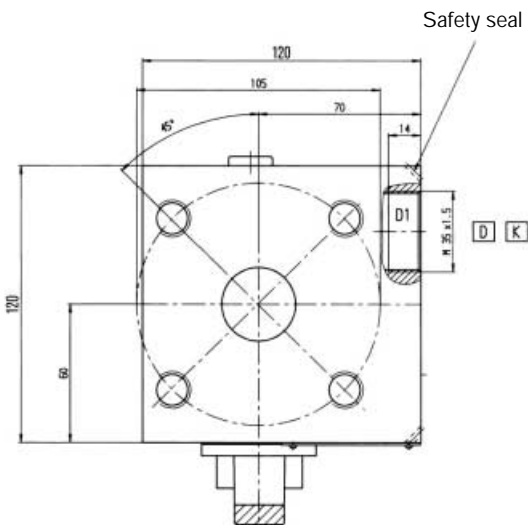
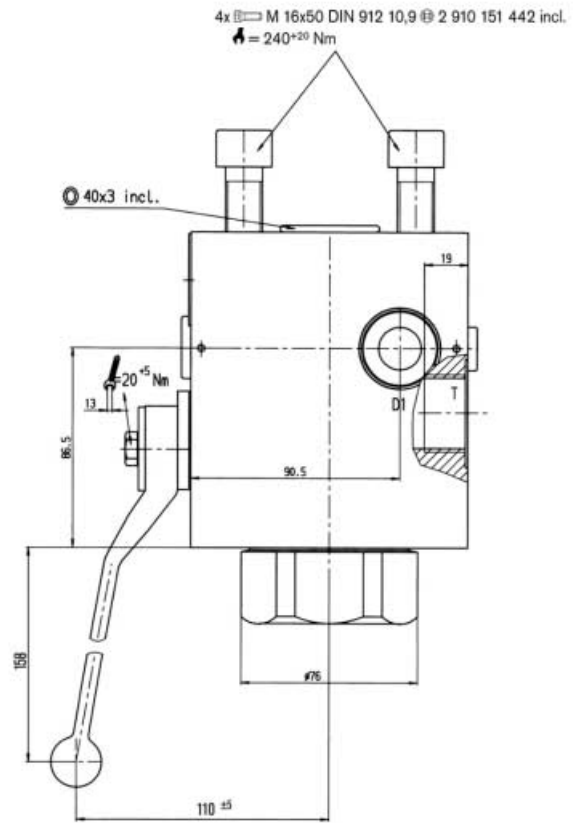
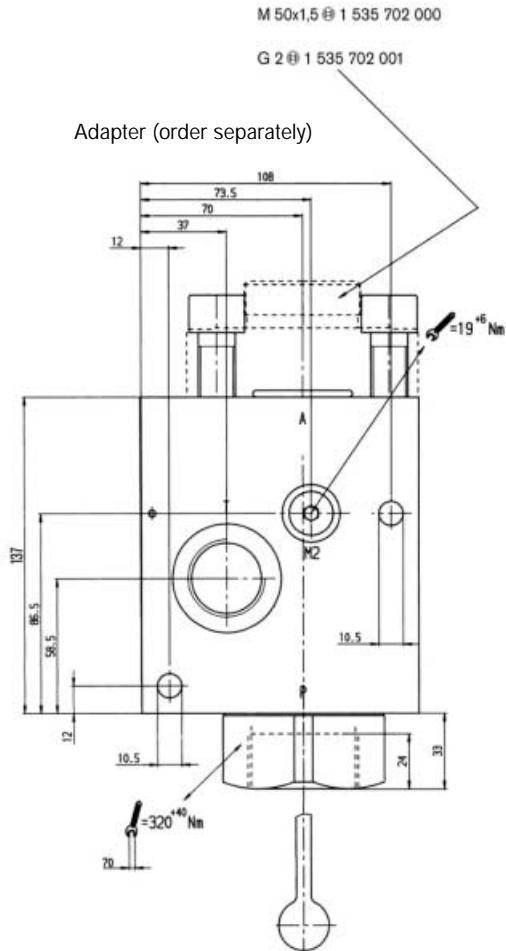
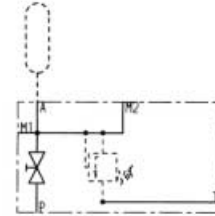
Dimensions – NG 20 (VAW20): dimensions in millimeters  
 With solenoid discharge valve





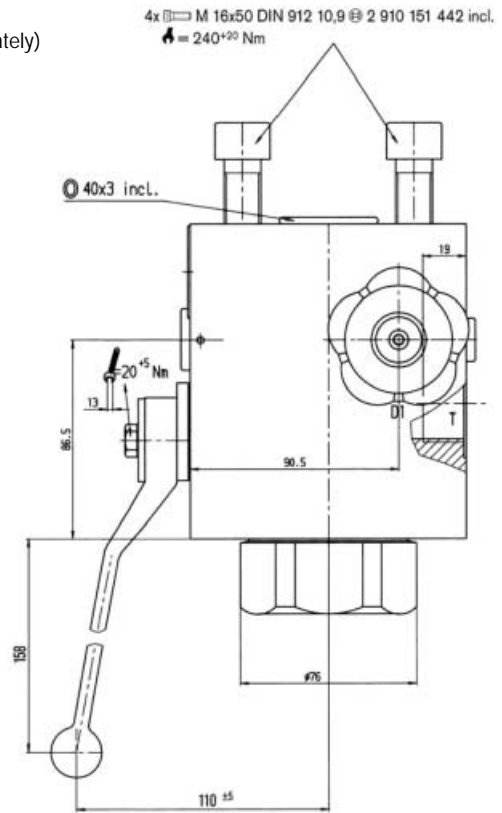
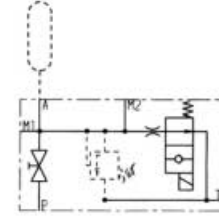
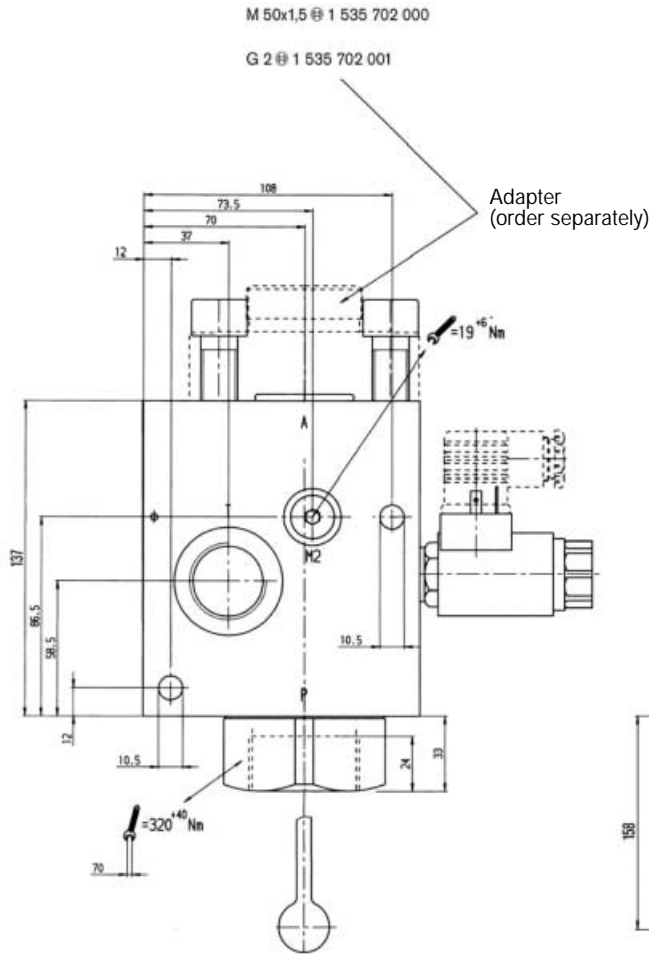
Dimensions – NG 32 (VAW32)

Pipe connection: dimensions in millimeters  
Without discharge valve

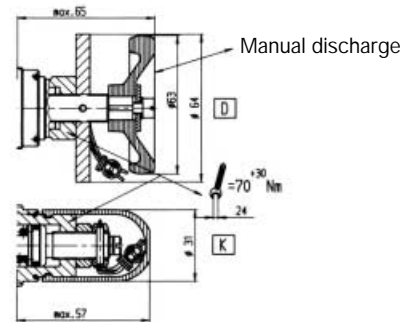
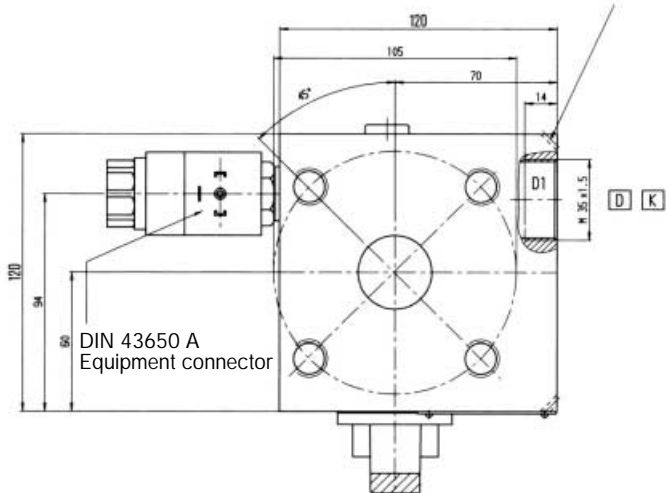


Dimensions – NG 32 (VAW32)

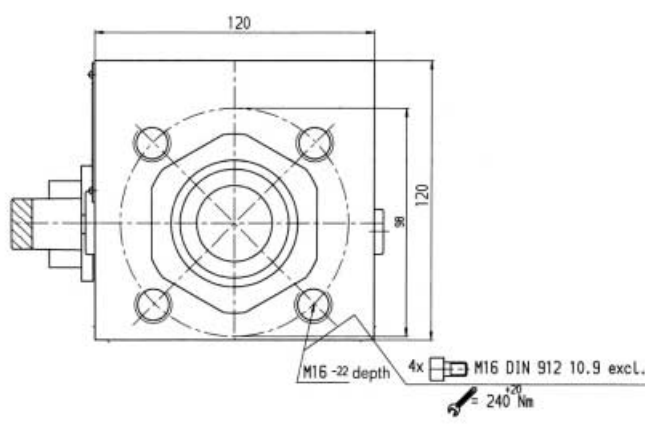
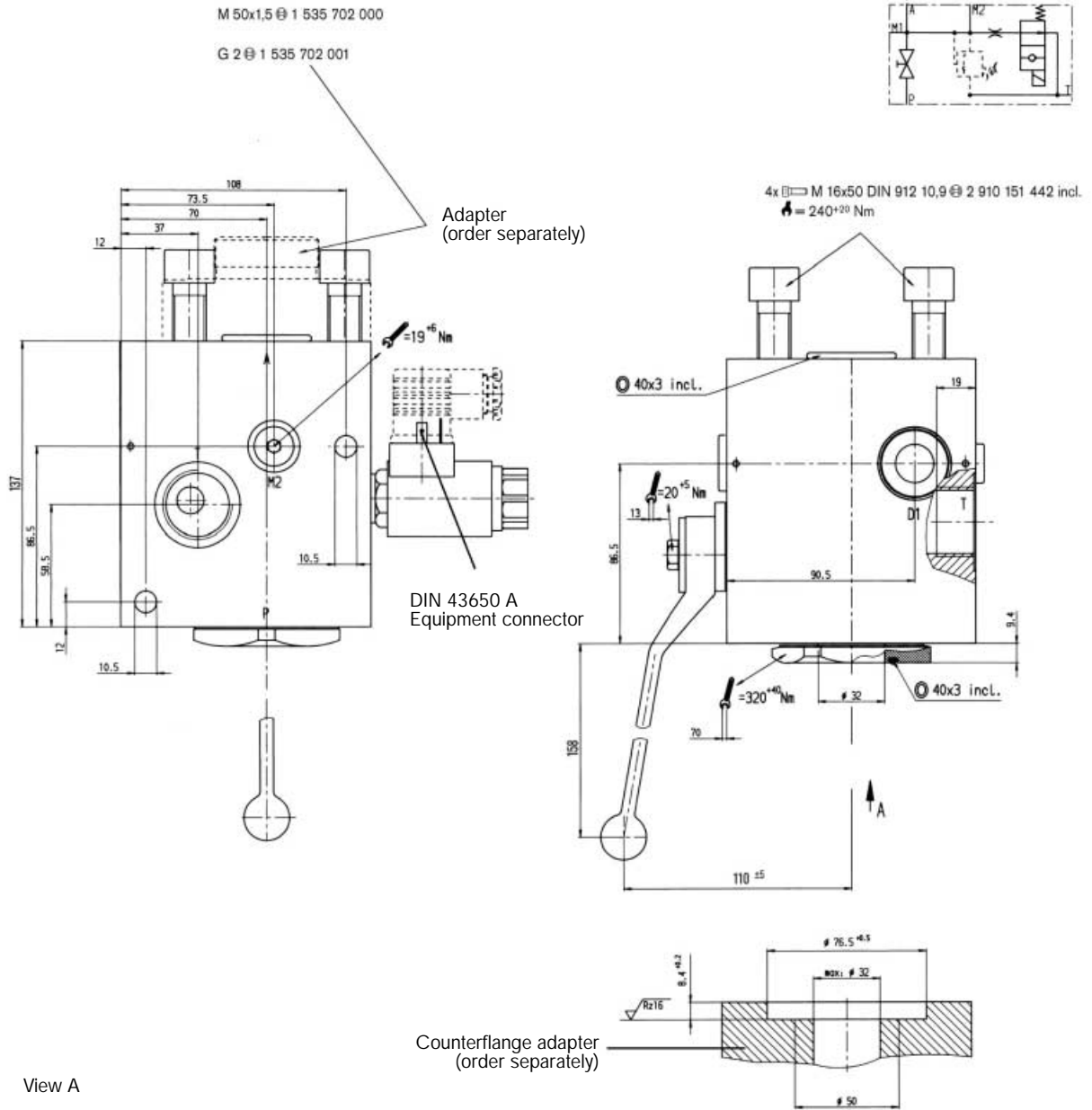
Pipe connection: dimensions in millimeters  
With solenoid discharge valve



Safety seal connections



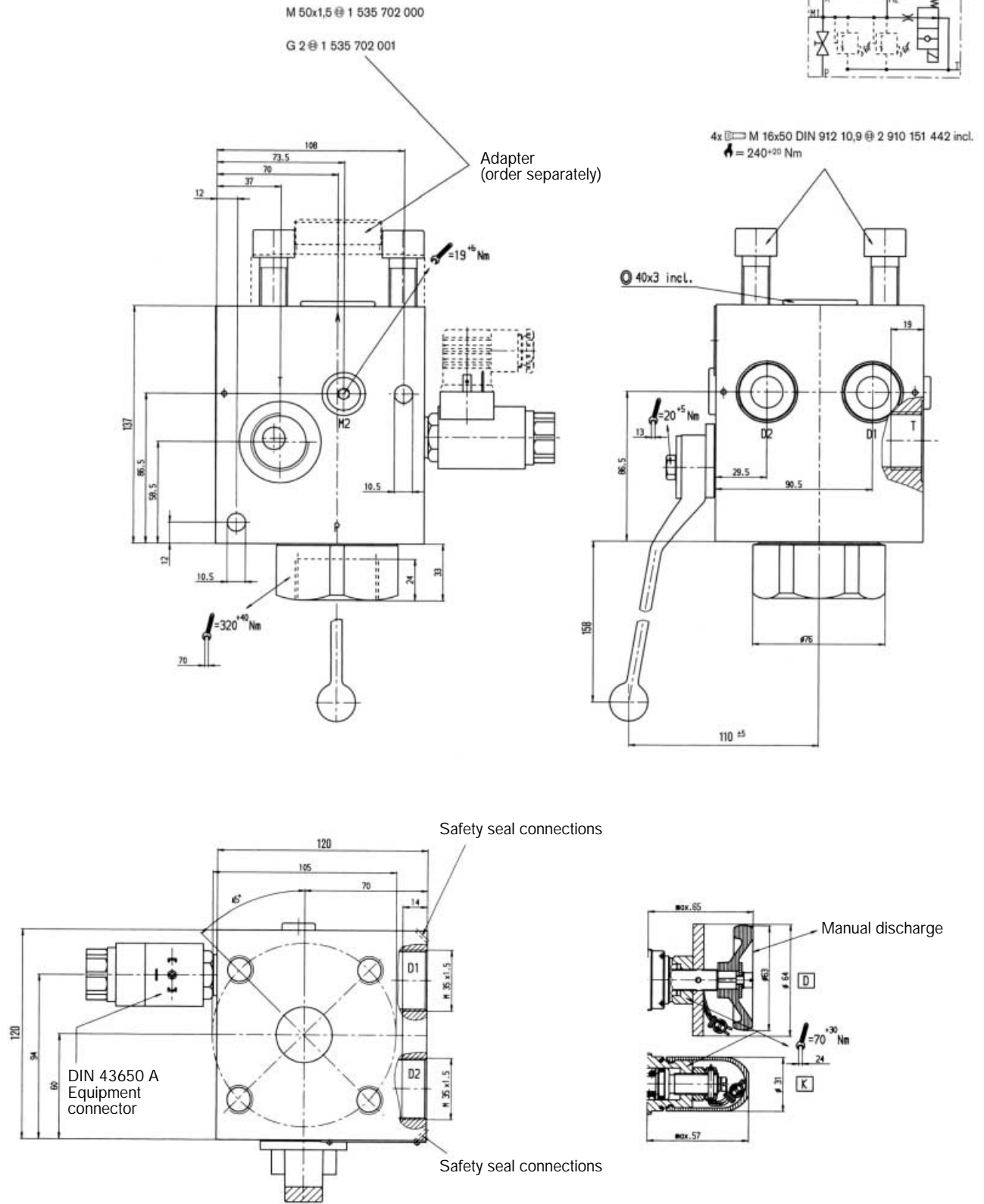
Dimensions – NG 32 (VAW32)  
 Flange connection: dimensions in millimeters  
 With solenoid discharge valve





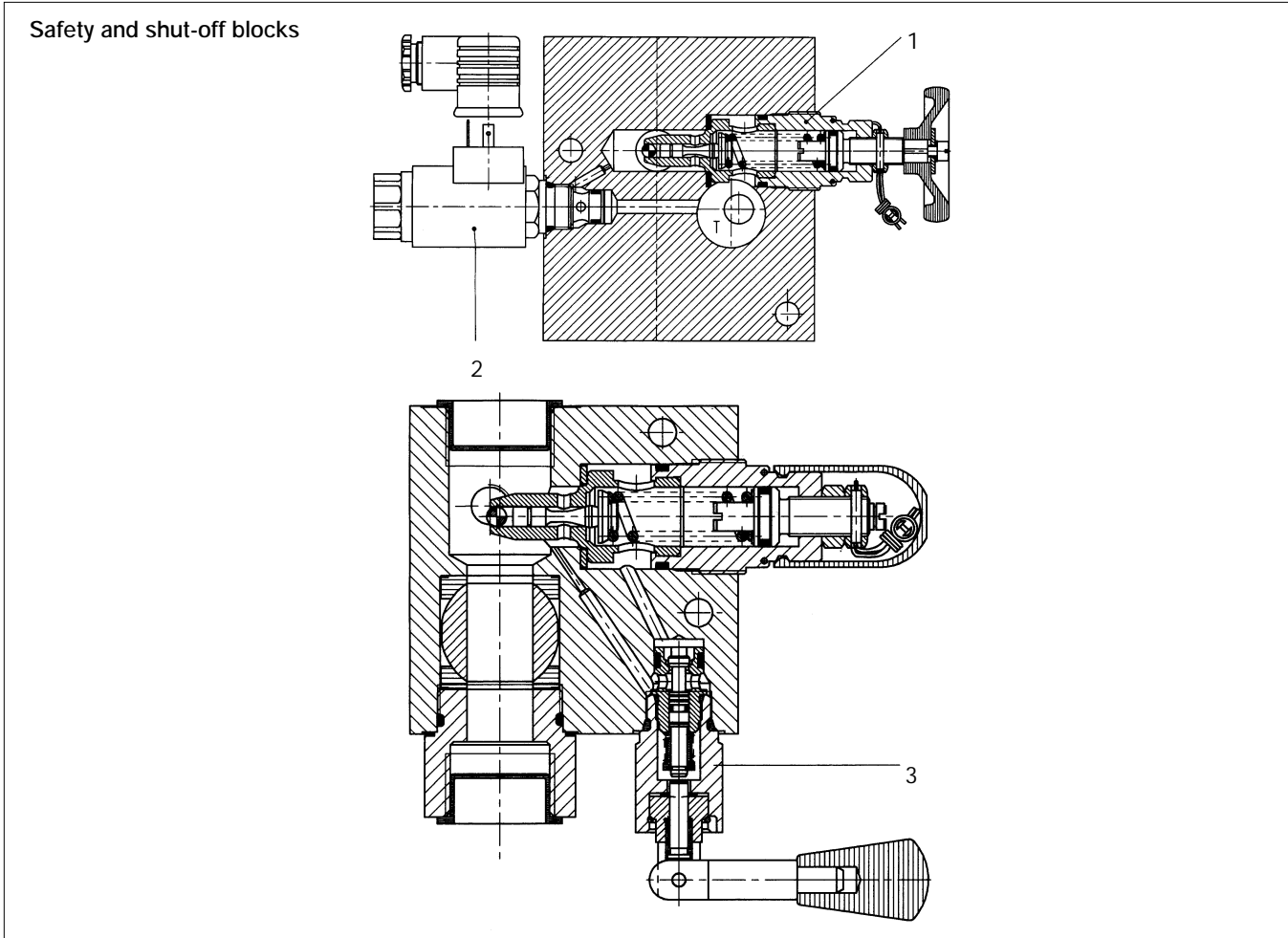
Dimensions – NG 32 (VAW32)

Pipe connection: dimensions in millimeters  
With solenoid discharge valve (dual relief)





# Safety Cartridge Valves

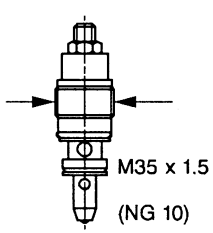




How to Order

Symbol	Description	Part Number
1	Cartridge valves 0 532 004 ...	see page 40
2	Solenoid valve 2/2, open without flow	24 V DC
		150 V DC
3	Directional control valve 2/2, manually operated	1 537 410 074
	Set of seals Solenoid and directional control valve	1 537 010 304
	Set of seals for Safety blocks VAW 20, VAW 32	1 537 010 300

**How to Order**  
**For cartridge-type**

 0 532 VA 03 N 050 D - 040

			p [bar]	Adjustment	G* [l/min]	[kg]	Part Number
14		<input checked="" type="checkbox"/> FPM	50	<input checked="" type="checkbox"/> 	40	0.4	0 532 004 200
			70		50		0 532 004 201
			100		100		0 532 004 202
			120		100		0 532 004 211
			140		100		0 532 004 203
			160		100		0 532 004 204
			200		100		0 532 004 209
			211		100		0 532 004 205
			250		130		0 532 004 206
			280		130		0 532 004 210
			300		130		0 532 004 207
			330		150		0 532 004 208
			50	<input checked="" type="checkbox"/> 	40	0.4	0 532 004 102
			70		50		0 532 004 103
			80		60		0 532 004 111
			100		100		0 532 004 104
			120		100		0 532 004 114
			140		100		0 532 004 107
			160		100		0 532 004 105
			180		100		0 532 004 113
			200		100		0 532 004 110
			211		100		0 532 004 100
			250		130		0 532 004 106
			260		130		0 532 004 115
			280	130	0 532 004 112		
			300	130	0 532 004 101		
			330	150	0 532 004 108		
			360	150	0 532 004 109		

 Set of seals  part number 1 537 010 236  part number 1 537 010 298

Specifications	
Design	Damped poppet valve, manual opening
Mounting	Cartridge installation
Installation position	As desired
Direction of flow	See symbols
Ambient temperature range	-13 °F ... +149 °F (-25 °C ... +65 °C)
TÜV codes	For cartridge installation:
Max. operating pressure	5000 psi (330 bar)
Excess flow G [l/min] and pNom bar	See tables on page 26 ... 28
Hydraulic fluid F	Mineral oils to DIN 51 524 and flame-resistant fluids to VDMA 24 317/24 320
Operating temperature range	+5 °F ... +176 °F (-15 °C ... +80 °C)
Viscosity range	2.2 ... 82 SUS (10 ... 380 mm <sup>2</sup> /s)
Δ p-Q characteristics	See table on page 29

# Accessories

## How to Order Adapters and flanges

### ① Accumulator ISO/Metric Thread Adapters

	Block	Accum.									
	D1	D2	SW	L	L1	L2	ø D3	ø D4		Part Number	
	M 33 x 2	M 50 x 1.5	70	61	18	20	75	20	1.4	1 533 359 002	
		M 30 x 1.5	46	51	18	14	53	18	0.4	1 533 359 003	
		G3/4 ISO 228	46	51	18	14	53	16	0.4	1 533 359 004	
		M 40 x 1.5	55	59	18	20	63	20	0.6	1 533 359 005	
		G1-1/4 ISO 228	55	59	18	20	63	20	0.4	1 533 359 006	
		G2 ISO 228	80	64	18	20	90	20	1.5	1 533 359 007	
		M 22 x 1.5	46	51	18	14	53	12	0.4	1 533 359 012	
M 18 x 1.5		46	51	18	14	53	8	0.4	1 533 359 013		

### ② Accumulator ISO/Metric Flange Adapters

	Block	Accum.			Part Number
		D2		[kg]	
	100 x 100	1-7/8 – 12 UNF SAE #24		2.0	US00883652
	100 x 100	M 50 x 1.5		2.0	1 535 702 000
	100 x 100	G2 - ISO 228		2.2	1 535 702 001

### ③ Accumulator Adapter Seal Rings

Adapter Part Number	N: Buna				V: Viton			
	ø R1	Part Number	ø R2	Part Number	ø R1	Part Number	ø R2	Part Number
1 533 359 002	36 x 2.5	1 530 210 080	53 x 3	1 530 210 074	36 x 2.5	1 530 210 081	53 x 3	1 530 210 075
1 533 359 003	36 x 2.5	1 530 210 080	33 x 2.5	1 530 210 078	36 x 2.5	1 530 210 081	33 x 2.5	1 530 210 079
1 533 359 004	36 x 2.5	1 530 210 080	33 x 2.5	1 530 210 078	36 x 2.5	1 530 210 081	33 x 2.5	1 530 210 079
1 533 359 005	36 x 2.5	1 530 210 080	43 x 2.5	1 530 210 076	36 x 2.5	1 530 210 081	43 x 2.5	1 810 210 178
1 533 359 006	36 x 2.5	1 530 210 080	45 x 2.5	1 530 210 045	36 x 2.5	1 530 210 081	45 x 2.5	1 520 210 101
1 533 359 007	36 x 2.5	1 530 210 080	62 x 3	1 530 210 083	36 x 2.5	1 530 210 081	62 x 3	—
1 533 359 012	36 x 2.5	1 530 210 080	—	1 530 206 008	36 x 2.5	1 530 210 081	—	—
1 533 359 013	36 x 2.5	1 530 210 080	—	1 530 206 009	36 x 2.5	1 530 210 081	—	—
1 535 702 000	40 x 3	1 900 210 143	53 x 3	1 530 210 074	40 x 3	—	53 x 3	1 530 210 075
1 535 702 001	40 x 3	1 900 210 143	62 x 3	1 530 210 083	40 x 3	—	62 x 3	—

### ④ Accumulator Metric to SAE Thread Adapters

Part Number	Description	Seal Required
US00883649	M 33 – 2 to SAE #24 (1-7/8 – 12 UNF)	N/A
US00883648	M 33 – 2 to SAE #20 (1-5/8 – 12 UNF)	N/A
US00883647	M 33 – 2 to SAE #16 (1-5/16 – 12 UNF)	N/A
US00883646	M 33 – 2 to SAE #12 (1-1/16 – 12 UNF)	N/A

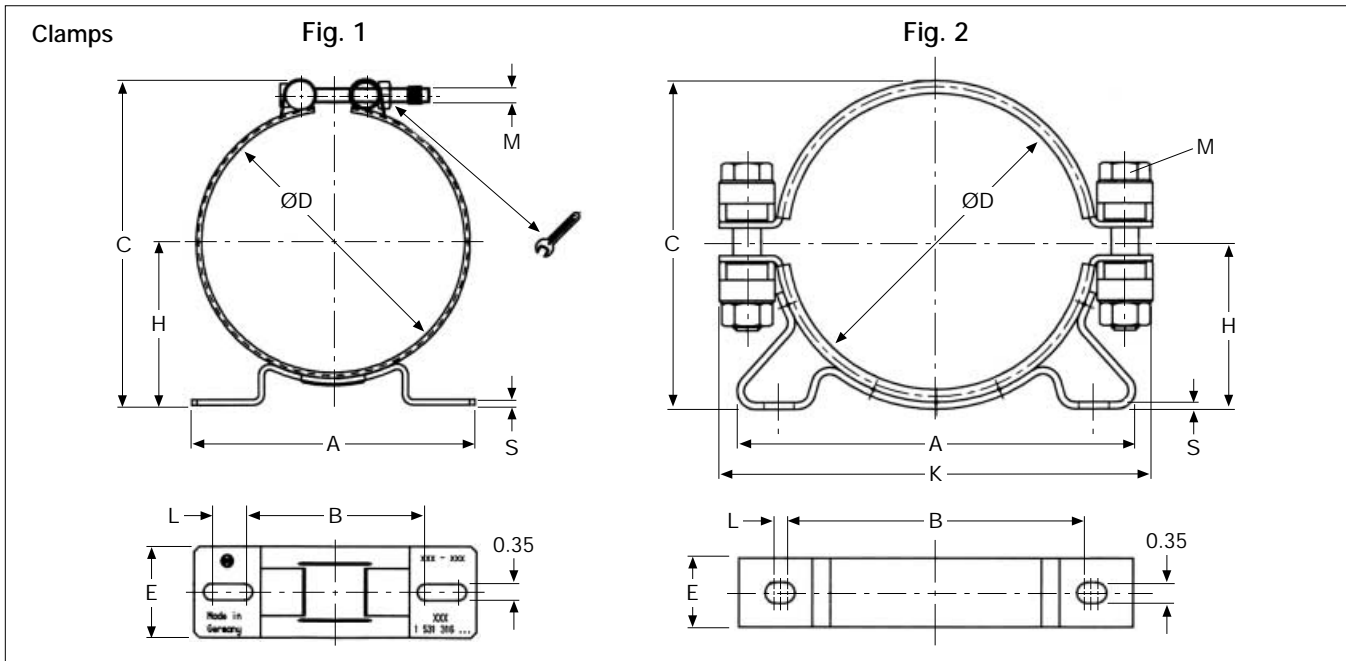
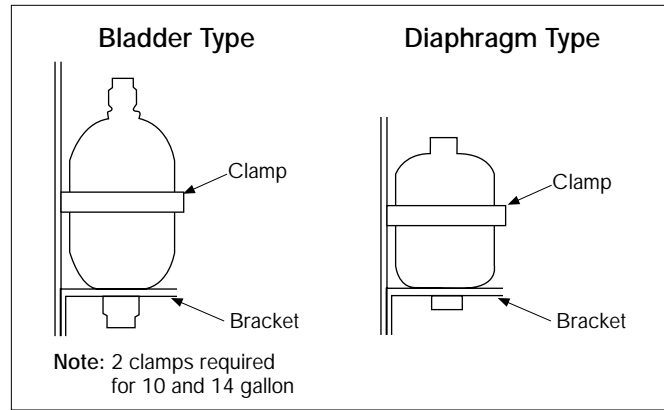
### ⑤ Safety Block ISO to SAE Port Adapters

Part Number	Description	Seal Required
US00810883	G1-1/2 to SAE #24 (1-7/8 – 12 UNF)	US00805164
US00810881	G1 to SAE #16 (1-5/16 – 12 UNF)	US00805160
US00810879	G1/2 to SAE #8 (3/4 – 16 UNF)	US00805142
US00810877	G1/4 to SAE #4 (7/16 – 20 UNF)	US00805148

Clamps and Brackets

Features:

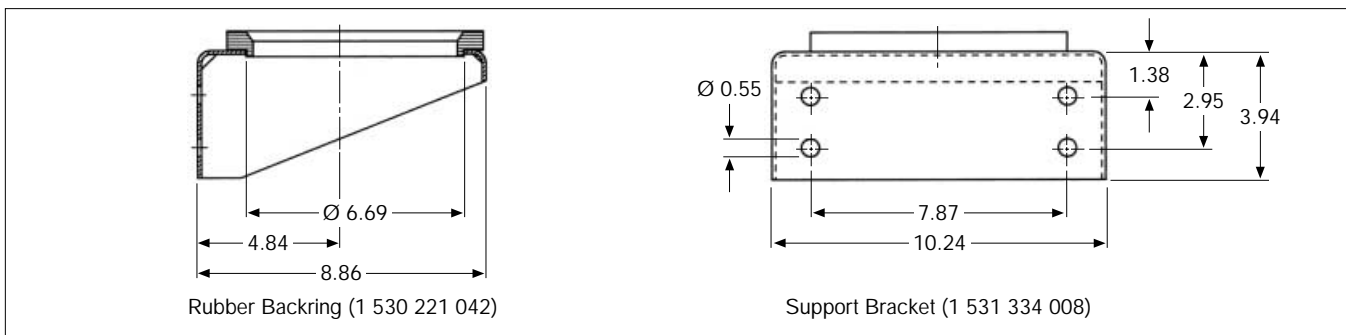
- Allows secure yet easy installation of accumulator in either vertical position for bladder type, or unrestricted position for diaphragm type.
- Brackets can be bolted or welded to supporting structure.
- Rubber cushioning on straps helps prevent noises from being transmitted through metal to metal contact.
- Sizes available for diaphragm and bladder units.
- Base bracket available for support of vertical mounting of large sizes.



How to Order

Accumulator Clamps (inches)													
Accumulator Size	Fig.	A	B	C	D	E	H	L	M	S	Weight	Part Number	Qty. Req.
21 cu in	1	2.71	3.34	4.61	3.62-3.82	1.57	2.93-3.13	0.31	M6	0.118	0.37	1 531 316 017	1
30 cu in	1	5.31	3.78	5.55	3.98-4.37	1.97	2.36-2.56	0.71	M8	0.118	0.75	1 531 316 018	1
1/4 gallon	1	5.31	3.78	5.91	4.33-4.72	1.97	2.52-2.71	0.71	M8	0.118	0.77	1 531 316 021	1
43 cu in	1	5.31	3.78	6.22	4.68-5.04	1.97	2.71-2.89	0.39	M8	0.118	0.71	1 531 316 015	1
85 & 122 cu in	1	6.14	3.94	7.28	5.71-6.10	1.97	3.15-3.31	0.71	M8	0.118	0.88	1 531 316 016	1
1 gallon	1	9.33	5.79	7.87	6.30-6.70	1.97	3.54-3.74	1.38	M8	0.157	1.26	1 531 316 022	2
170 cu in	1	9.33	5.79	8.27	6.70-7.09	1.97	3.74-3.94	1.38	M8	0.157	1.30	1 531 316 020	1
2-1/2 to 14 gallon*	2	7.24	8.50	9.61	8.81-9.06	1.18	4.72-4.84	0.51	M12	0.118	3.75	1 531 316 005	1 to 2

\*10 and 14 gallon require two (2) clamps.



Gauging and Safety Elements

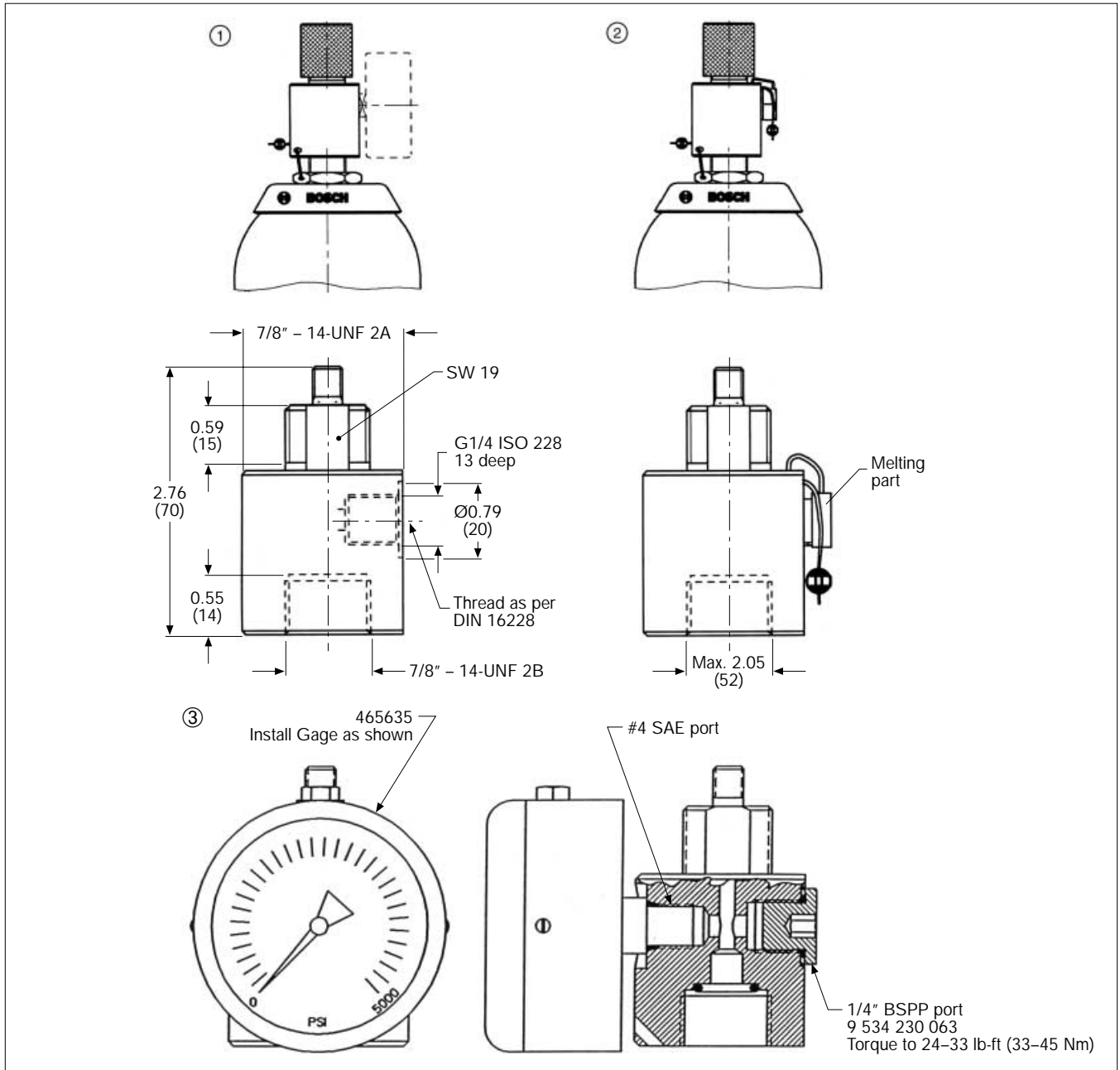
Gas-side safety elements for recognizing pressure and limiting the temperature

The gas-side safety elements comply with the "Technical Regulations for Pressure Vessels" TRB 403

⚠ For your safety

Read the installation instructions carefully before commissioning.

- Assembly may only be performed by expert personnel.
- All work on accumulators may only be carried out when pressure is fully discharged.
- The safety elements or pressure gauge must not be removed while accumulators are under pressure.
- The gas valve may only be connected via the adapter, not to the accumulator itself, otherwise the safety elements are ineffectual.



How to Order

Pos.		Maximum working pressure	Part Number
①	Adapter for pressure gauge	4351 psi (300 bar)	1 535 400 171
②	Melting point: 361-374 °F (183-190 °C)	4786 psi (330 bar)	1 535 400 170
③	Adapter w/ 5000 psi gauge	4351 psi (300 bar)	9 530 231 123

Charging and Testing Kits

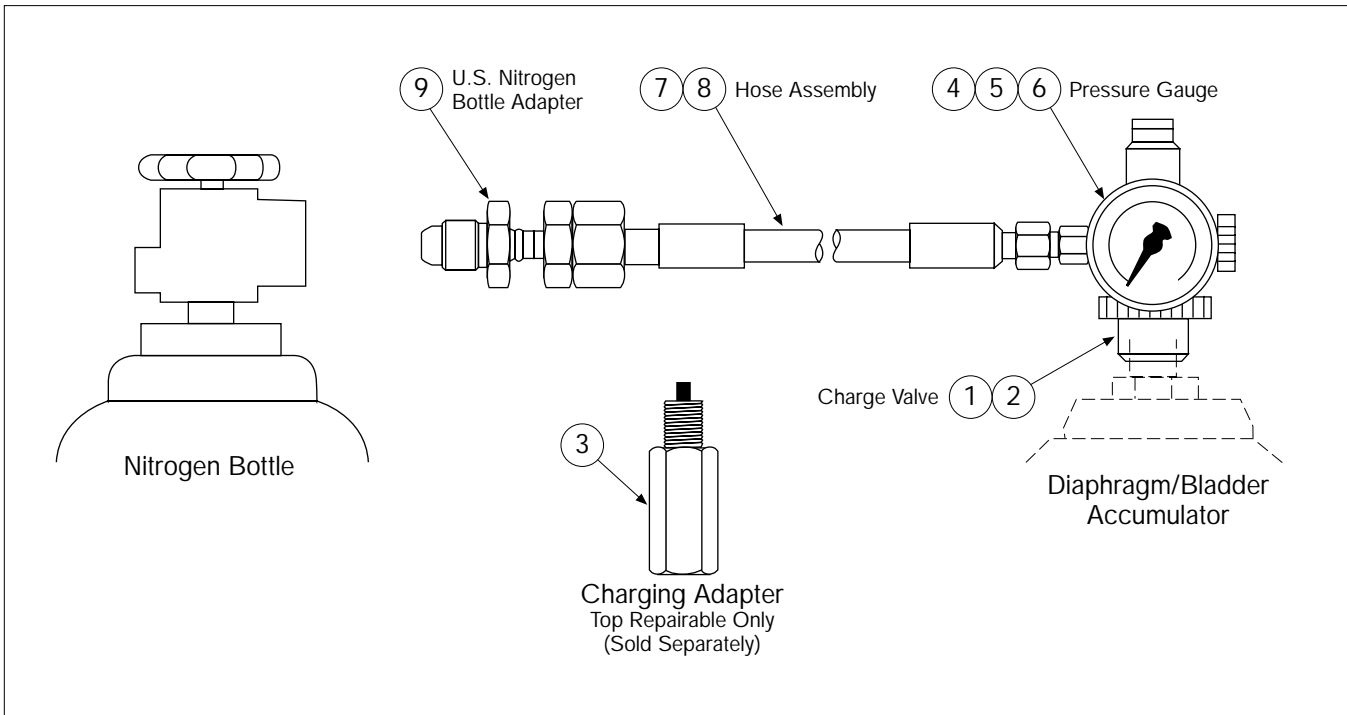


How to Order

Description	Part Number
Complete Assembly – Metric diaphragm accumulators (Includes items: 2, 5, & 7) M28 x 1.5 Note: Must purchase Nitrogen bottle adapter 1 533 391 012 separately	0 538 103 012
Complete Assembly – Bladder type & U.S. version Diaphragm type (Includes items 1, 5, 7, & 9) SAE 7/8" – 14 UNF	0 538 103 013
Dual Assembly – Bladder type, U.S. version & Metric Diaphragm type (Includes items 1, 2, 5 [2 pcs.], 7, & 9)	0 538 103 014

Note: Maximum charge valve pressure – 5000 psi

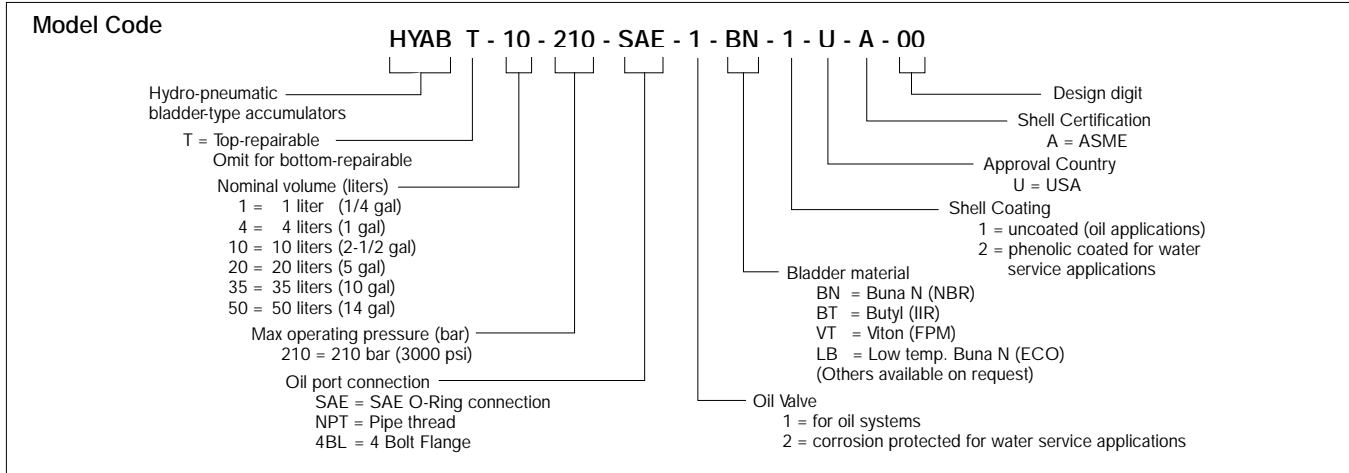
Spare Parts



How to Order

Item #	Description	Part Number
0	Seal kits	For charge valve 0 538 103 005
		For charge valve 0 538 103 006
0	Carrying case only	1 537 000 002
1	Charge and testing valve	bladder & U.S. version diaphragm SAE 7/8" – 14 UNF
2		diaphragm type European M28 x 1.5
3	Adapter – for charging top repairable accumulators	9 530 230 024
4	Pressure gauge	0–870 psi (0–60 bar) optional
5		0–3626 psi (0–250 bar)
6		0–5802 psi (0–400 bar) optional
7	Hose	98 inches (2.5 meters)
8		197 inches (5 meters) optional
9	Adapter – for connecting the Metric hose to American nitrogen bottles.	1 533 391 012

# Accumulator Model Code Listing



Bladder Accumulators		Part Number	Model Code
0531012700	HY/AB1/330/10/G(M30X1.5)/1/NBR/1/D/T}V,BMP/1	0531114645	HYAB-10-210-1-7/8-12UN-2B-LB-1-U-A-00
0531013700	HY/AB4/330/10/G(M40X1.5)/1/NBR/1/D/T}V/BMP/1	0531115610	HYAB-20-210-2NPT-BN-1-U-A-00
0531014722	HY/AB/10/330/10/G(M50X1.5)/1/NBR/1/D/T}V,BMP/2	0531115611	HYAB-20-210-2NPT-BT-1-U-A-00
0531015760	HY/AB/35/330/10/G(M50X1.5)/1/NBR/1/D/TUEV/BMP/2	0531115612	HYAB-20-210-2NPT-BN-2-U-A-00
0531015761	HY/AB/20/330/10/G(M50X1.5)/1/NBR/1/D/TUEV/BMP/2	0531115613	HYAB-20-210-2NPT-VT-1-U-A-00
0531016722	HY/AB/50/330/10/G(M50X1.5)/1/NBR/1/TUEV/BMP/2	0531115615	HYAB-20-210-2NPT-LB-1-U-A-00
0531112610	HYAB-1-210-3/4NPT-BN-1-U-A-00	0531115630	HYAB-35-210-2NPT-BN-1-U-A-00
0531112611	HYAB-1-210-3/4NPT-BT-1-U-A-00	0531115631	HYAB-35-210-2NPT-BT-1-U-A-00
0531112612	HYAB-1-210-3/4NPT-BN-2-U-A-00	0531115632	HYAB-35-210-2NPT-BN-2-U-A-00
0531112613	HYAB-1-210-3/4NPT-VT-1-U-A-00	0531115633	HYAB-35-210-2NPT-VT-1-U-A-00
0531112615	HYAB-1-210-3/4NPT-LB-1-U-A-00	0531115635	HYAB-35-210-2NPT-LB-1-U-A-00
0531112640	HYAB-1-210-1-3/16-12UN-2B-BN-1-U-A-00	0531115640	HYAB-20-210-1-7/8-12UN-2B-BN-1-U-A-00
0531112641	HYAB-1-210-1-3/16-12UN-2B-BT-1-U-A-00	0531115641	HYAB-20-210-1-7/8-12UN-2B-BT-1-U-A-00
0531112642	HYAB-1-210-1-3/16-12UN-2B-BN-2-U-A-00	0531115642	HYAB-20-210-1-7/8-12UN-2B-BN-2-U-A-00
0531112643	HYAB-1-210-1-3/16-12UN-2B-VT-1-U-A-00	0531115643	HYAB-20-210-1-7/8-12UN-2B-VT-1-U-A-00
0531112645	HYAB-1-210-1-3/16-12UN-2B-LB-1-U-A-00	0531115645	HYAB-20-210-1-7/8-12UN-2B-LB-1-U-A-00
0531113610	HYAB-4-210-1-1/4NPT-BN-1-U-A-00	0531115650	HYAB-35-210-1-7/8-12UN-2B-BN-1-U-A-00
0531113611	HYAB-4-210-1-1/4NPT-BT-1-U-A-00	0531115651	HYAB-35-210-1-7/8-12UN-2B-BT-1-U-A-00
0531113612	HYAB-4-210-1-1/4NPT-BN-2-U-A-00	0531115652	HYAB-35-210-1-7/8-12UN-2B-BN-2-U-A-00
0531113613	HYAB-4-210-1-1/4NPT-VT-1-U-A-00	0531115653	HYAB-35-210-1-7/8-12UN-2B-VT-1-U-A-00
0531113615	HYAB-4-210-1-1/4NPT-LB-1-U-A-00	0531115655	HYAB-35-210-1-7/8-12UN-2B-LB-1-U-A-00
0531113640	HYAB-4-210-1-5/8-12UN-2B-BN-1-U-A-00	0531116610	HYAB-50-210-2NPT-BN-1-U-A-00
0531113641	HYAB-4-210-1-5/8-12UN-2B-BT-1-U-A-00	0531116611	HYAB-50-210-2NPT-BT-1-U-A-00
0531113642	HYAB-4-210-1-5/8-12UN-2B-BN-2-U-A-00	0531116612	HYAB-50-210-2NPT-2-BN-2-U-A-00
0531113643	HYAB-4-210-1-5/8-12UN-2B-VT-1-U-A-00	0531116613	HYAB-50-210-2NPT-VT-1-UA00
0531113645	HYAB-4-210-1-5/8-12UN-2B-LB-1-U-A-00	0531116615	HYAB-50-210-2NPT-LB-1-UA00
0531114610	HYAB-10-210-2NPT-BN-1-U-A-00	0531116640	HYAB-50-210-1-7/8-12UN-2B-BN-1-U-A-00
0531114611	HYAB-10-210-2NPT-BT-1-U-A-00	0531116641	HYAB-50-210-1-7/8-12UN-2B-BT-1-U-A-00
0531114612	HYAB-10-210-2NPT-BN-2-U-A-00	0531116642	HYAB-50-210-1-7/8-12UN-2B-BN-2-U-A-00
0531114613	HYAB-10-210-2NPT-VT-1-U-A-00	0531116643	HYAB-50-210-1-7/8-12UN-2B-VT-1-U-A-00
0531114615	HYAB-10-210-2NPT-LB-1-U-A-00	0531116645	HYAB-50-210-1-7/8-12UN-2B-LB-1-U-A-00
0531114640	HYAB-10-210-1-7/8-12UN-2B-BN-1-U-A-00	9530230075	HYABT-10-210-1-7/8-12UN-2B-BN-1-UA00
0531114641	HYAB-10-210-1-7/8-12UN-2B-BT-1-U-A-00	9530230076	HYABT-10-210-1-7/8-12UN-2B-BT-1-UA00
0531114642	HYAB-10-210-1-7/8-12UN-2B-BN-2-U-A-00	9530230077	HYABT-10-210-1-7/8-12UN-2B-BN-2-U-A-00
0531114643	HYAB-10-210-1-7/8-12UN-2B-VT-1-U-A-00	9530230078	HYABT-10-210-1-7/8-12UN-2B-VT-1-U-A-00
		9530230079	HYABT-10-210-1-7/8-12UN-2B-LB-1-U-A-00

## Bladder Accumulators (cont.)

## Part Number Model Code

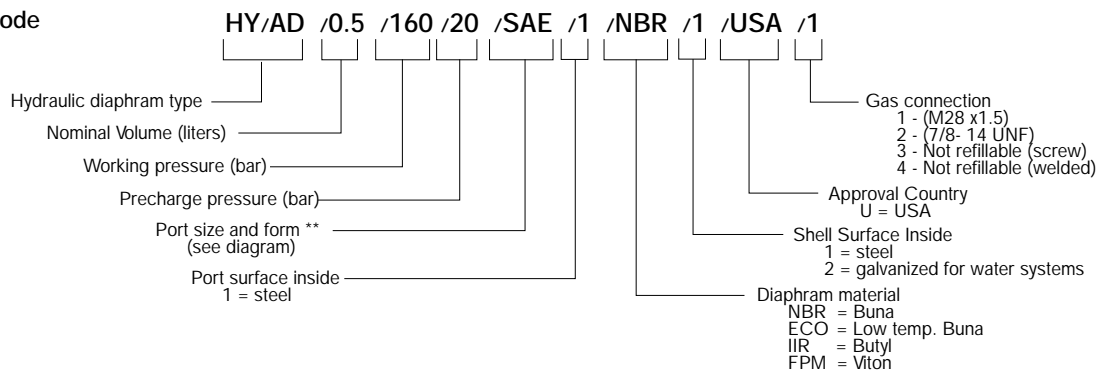
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9530230086	HYABT-20-210-1-7/8-12UN-2B-BT-1-U-A-00
9530230087	HYABT-20-210-1-7/8-12UN-2B-BN-2-U-A-00
9530230088	HYABT-20-210-1-7/8-12UN-2B-VT-1-U-A-00
9530230089	HYABT-20-210-1-7/8-12UN-2B-LB-1-U-A-00
9530230095	HYABT-35-210-1-7/8-12UN-2B-BN-1-U-A-00
9530230096	HYABT-35-210-1-7/8-12UN-2B-BT-1-U-A-00
9530230097	HYABT-35-210-1-7/8-12UN-2B-BN-2-U-A-00
9530230098	HYABT-35-210-1-7/8-12UN-2B-VT-1-U-A-00
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9530230105	HYABT-50-210-1-7/8-12UN-2B-BN-1-U-A-00
9530230106	HYABT-50-210-1-7/8-12UN-2B-BT-1-U-A-00
9530230107	HYABT-50-210-1-7/8-12UN-2B-BN-2-U-A-00
9530230108	HYABT-50-210-1-7/8-12UN-2B-VT-1-U-A-00
9530230109	HYABT-50-210-1-7/8-12UN-2B-LB-1-U-A-00
9530230110	HYAB-10-210-4BL-1-BN-1-U-A-00
9530230111	HYAB-10-210-4BL-1-BT-1-U-A-00
9530230112	HYAB-10-210-4BL-2-BN-2-U-A-00
9530230113	HYAB-10-210-4BL-1-VT-1-U-A-00
9530230114	HYAB-10-210-4BL-1-LB-1-U-A-00
9530230115	HYAB-20-210-4BL-1-BN-1-U-A-00
9530230116	HYAB-20-210-4BL-1-BT-1-U-A-00
9530230117	HYAB-20-210-4BL-2-BN-2-U-A-00
9530230118	HYAB-20-210-4BL-1-VT-1-U-A-00
9530230119	HYAB-20-210-4BL-1-LB-1-U-A-00
9530230120	HYAB-35-210-4BL-1-BN-1-U-A-00
9530230121	HYAB-35-210-4BL-1-BT-1-U-A-00

## Part Number

## Model Code

9530230122	HYAB-35-210-4BL-2-BN-2-U-A-00
9530230123	HYAB-35-210-4BL-1-VT-1-U-A-00
9530230124	HYAB-35-210-4BL-1-LB-1-U-A-00
9530230125	HYAB-50-210-4BL-1-BN-1-U-A-00
9530230126	HYAB-50-210-4BL-1-BT-1-U-A-00
9530230127	HYAB-50-210-4BL-2-BN-2-U-A-00
9530230128	HYAB-50-210-4BL-1-VT-1-U-A-00
9530230129	HYAB-50-210-4BL-1-LB-1-U-A-00
9530230130	HYABT-10-210-4BL-1-BN-1-U-A-00
9530230131	HYABT-10-210-4BL-1-BT-1-U-A-00
9530230132	HYABT-10-210-4BL-2-BN-2-U-A-00
9530230133	HYABT-10-210-4BL-1-VT-1-U-A-00
9530230134	HYABT-10-210-4BL-1-LB-1-U-A-00
9530230135	HYABT-20-210-4BL-1-BN-1-U-A-00
9530230136	HYABT-20-210-4BL-1-BT-1-U-A-00
9530230137	HYABT-20-210-4BL-2-BN-2-U-A-00
9530230138	HYABT-20-210-4BL-1-VT-1-U-A-00
9530230139	HYABT-20-210-4BL-1-LB-1-U-A-00
9530230140	HYABT-35-210-4BL-1-BN-1-U-A-00
9530230141	HYABT-35-210-4BL-1-BT-1-U-A-00
9530230142	HYABT-35-210-4BL-2-BN-2-U-A-00
9530230143	HYABT-35-210-4BL-1-VT-1-U-A-00
9530230144	HYABT-35-210-4BL-1-LB-1-U-A-00
9530230145	HYABT-50-210-4BL-1-BN-1-U-A-00
9530230146	HYABT-50-210-4BL-1-BT-1-U-A-00
9530230147	HYABT-50-210-4BL-2-BN-2-U-A-00
9530230148	HYABT-50-210-4BL-1-VT-1-U-A-00
9530230149	HYABT-50-210-4BL-1-LB-1-U-A-00

## Model Code



## Diaphragm Accumulators

## Part Number Model Code

0531600611	HY/AD/0,16/250/-/S(9/16-18UNF-2B)/1/NBR/1/USA/HP/2
0531601549	HY/AD/0,35/160/-/A(3/4-16UNF-2B)/1/NBR/1/USA/HP/2
0531601567	HY/AD/0,35/160/-/A(3/4-16UNF-2B)/1/FPM/1/USA/HP/2
0531602560	HY/AD/0,7/180/-/A(3/4-16UNF-2B)/1/NBR/1/USA/HP/2
0531602588	HY/AD/0,7/207/-/C(3/4-16UNF-2B)/1/NBR/1/USA/HP/2
0531603501	HY/AD/1,4/207/-/C(3/4-16UNF-2B)/1/NBR/1/USA/-/2
0531610632	HY/AD/0,075/250/-/S(9/16-18UNF-2B)/1/NBR/1/USA/HP/2
0531611527	HY/AD/0,5/160/110/A(3/4-16UNF-2B)/1/NBR/1/USA/HP/2
0531611603	HY/AD/0,5/211/110/A(3/4-16UNF-2B)/1/NBR/USA/HP/2
0531613503	HY/AD/2,8/207/-/C(3/4-16UNF-2B)/1/NBR/1/USA/-/2
0531613504	HY/AD/2,8/207/-/C(3/4-16UNF-2B)/1/ECO/1/USA/-/2
0531613505	HY/AD/2,8/207/-/C(3/4-16UNF-2B)/1/IIR/1/USA/-/2
0531623500	HY/AD/2,0/207/-/C(3/4-16UNF-2B)/1/NBR/1/USA/-/2

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982379	23	0 531 116 643	10	0 532 016 060	27	9 530 230 087	10
982381	18	0 531 116 645	10	0 532 016 061	27	9 530 230 088	10
982383	18	0 531 600 611	13	0 532 016 063	28	9 530 230 089	10
982384	18	0 531 601 549	13	0 532 016 070	28	9 530 230 095	10
982385	18	0 531 601 567	13	0 532 016 072	28	9 530 230 096	10
987626	18	0 531 602 560	13	0 538 103 005	44	9 530 230 097	10
0 531 012 700	11	0 531 602 588	13	0 538 103 006	44	9 530 230 098	10
0 531 013 700	11	0 531 603 501	13	0 538 103 012	44	9 530 230 099	10
0 531 014 722	11	0 531 610 632	13	0 538 103 013	44	9 530 230 105	10
0 531 015 760	11	0 531 611 527	13	0 538 103 014	44	9 530 230 106	10
0 531 015 761	11	0 531 611 603	13	0 811 106 033	15	9 530 230 107	10
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0 531 112 612	10	0 531 623 500	13	1 530 206 008	41	9 530 230 111	10
0 531 112 613	10	0 532 004 100	39	1 530 206 009	41	9 530 230 112	10
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0 531 112 640	10	0 532 004 102	39	1 530 210 074	41	9 530 230 114	10
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0 531 116 640	10	0 532 016 056	27	9 530 230 079	10		



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