# Top-bred

# FINAL TEST

# Written exam for hydraulic course CETOP level II

# Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Company\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Time available: 2 hours**

**Task 25 multiple choice questions**

**The student should start the final test on signal from the instructor**

**Mark the correct alternative(s) with an X**

**Wrong entry: Black out the wrong entry, and mark the correct alternative with an X.**

**Qualifying score: 60% (15 correct answers)**

Date: Time available: 30 min.

Tasks: 20 Multiple Choice Questions

The student should start the final test on signal from the instructor.

Mark the correct alternative with an X.

Wrong entry: Black out the wrong entry, and mark the correct alternative with a new X.

Qualifying score: 70% (14 correct answers)

) correct answers

Date: Time available: 30 min.

Tasks: 20 Multiple Choice Questions

The student should start the final test on signal from the instructor.

Mark the correct alternative with an X.

Wrong entry: Black out the wrong entry, and mark the correct alternative with a new X.

Qualifying score: 70% (14 correct answers)

) correct answers

# Formula sheet

**Flow and velocity:**

A = cm2  
v = m/min

**Pressure:**

p = bar  
F = daN  
A =cm2

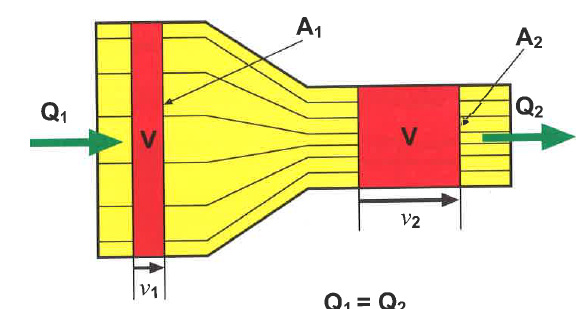
**Flowrate:**

V = L/min  
A = cm2

**Hydraulic power:**

p = bar  
V = L/min

## The Flow Law



The flow rate Q1 entering a pipe, is equal to the flowrate Q2 leaving the pipe. The area A1 is 100 cm2, the velocity v1 is 51 m/min. and the area A2 60 cm2.

What is the velocity v2 of the fluid?

* **63 m/min**
* **67 m/min**
* **77 m/min**
* **85 m/min**

## Pressure

F = 500 daN

A1 = 15 cm2

A2 = 10 cm2

The flow in the system is 10 L/min. What are the 2 system pressures when the piston is moving in positive and negative direction?

* **30 bar positive / 45 bar negative**
* **33 bar positive / 50 bar negative**
* **35 bar positive / 52 bar negative**
* **37 bar positive / 55 bar negative**

## Flowrate

F = 500 daN

A1 = 15 cm2

A2 = 10 cm2

The flow in the system is 10 L/min. How fast will the piston move in positive and negative direction?

* **0,11 m/min positive / 0,16 m/min negative**
* **1,1 m/min positive / 1,6 m/min negative**
* **11 m/min positive / 16 m/min negative**
* **7 m/min positive / 5,5 m/min negative**

## Hydraulic power

The oil flow thru a motor is 100 L/min. and the system pressure is 240 bar.  
What is the motors hydraulic power?

* **25 kW**
* **37 kW**
* **40 kW**
* **42 kW**

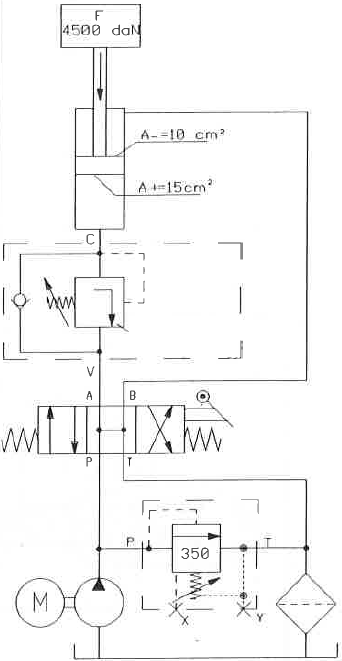
## Flow control

Which configuration would be most appropriate to use to control the piston speed in plus direction?

|  |  |
| --- | --- |
| No. 1 | No. 2 |
|  |  |
| No. 3 | No. 4 |
|  |  |

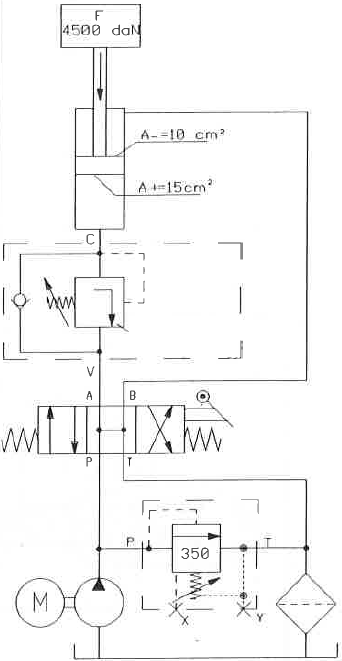
* **No. 1**
* **No. 2**
* **No. 3**
* **No. 4**

## Brake valve

Which pressure can be measured in point C?

* **P = 200 bar**
* **P = 250 bar**
* **P = 300 bar**
* **P = 325 bar**

## Brake valve

The valves opening pressure should be adjusted to a higher value than the pressure from the load. How much higher should the opening pressure be adjusted to?

* **1,10 x P**
* **1,20 x P**
* **1,25 x P**
* **1,30 x P**

## Hydraulic symbols

The 4 drawings show different hydraulic symbols. Write the drawing number next to the correct reference in the table below.

|  |  |
| --- | --- |
| No. 1 | No. 2 |
|  |  |
| No. 3 | No.4 |
|  |  |

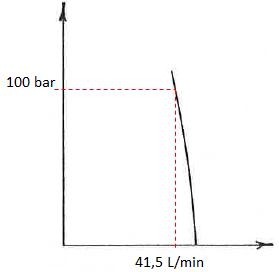
|  |  |
| --- | --- |
| **Valve no.** | **The correct term for the valve** |
|  | Variable displacement pump with pressure compensator, 1 direction of flow, 1 direction of rotation, case drain port |
|  | Variable displacement pump, 2 directions of flow, 1 direction of rotation, case drain port |
|  | Fixed displacement pump/motor, 1 direction of flow, 1 direction of rotation |
|  | Fixed displacement motor, 2 directions of flow, 2 directions of rotation |

## Pumps

The 3 drawings show different pump compensating systems. Write the drawing number next to the correct reference in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. 1 | | No. 2 | | |
|  | |  | | |
| No. 3 | |  | | |
|  | |
| **Pump no.** | | **The correct term for compensation** |
|  | | Pressure compensation |
|  | | Flow compensation |
|  | | Load sensing |

## Pump characteristic - Volumetric efficiency



A pump´s displacement is 50 L/min. But when testing the pump at 100 bar pressure, the flow is 41,5 L/min. What is the pumps volumetric efficiency at 100 bar?

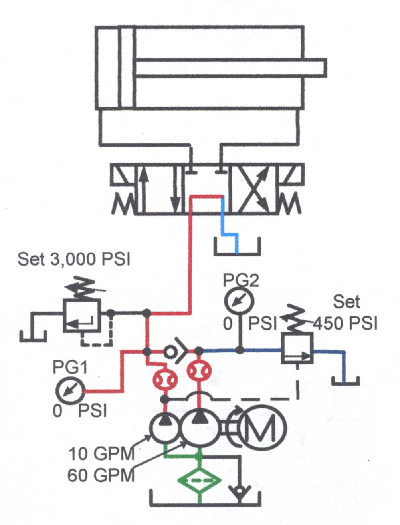
* **0,72**
* **0,75**
* **0,81**
* **0,83**

## Pump Characteristic – Total efficiency.

The pump from previous task has a mechanical efficiency at 0,81. What is the pumps total efficiency at 100 bar?

* **0,65**
* **0,67**
* **0,81**
* **0,82**

## HI –LO pump



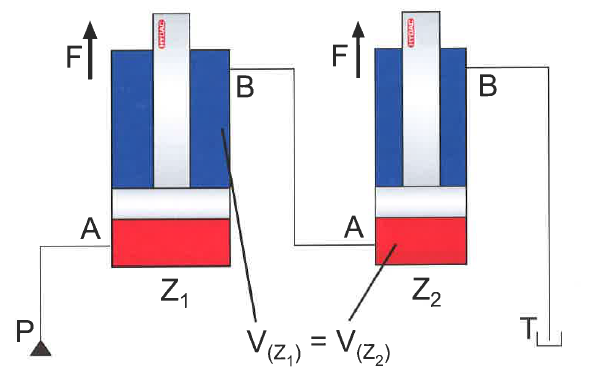
F = 2000 daN

When the piston is moving in positive direction, the friction, and weight of the piston generate a force of 100 daN. The system shall be supplied from both pumps. When the piston reaches the box, a force of 2000 daN is generated, and only 1 pump shall supply the system. 1 Gallon = 4,7 L

What would be the correct adjustment for pressure relieve valve 1 and 2?

|  |  |  |  |
| --- | --- | --- | --- |
| **Pressure relive valve 1** | | **Pressure relieve valve 2** | |
|  | >65 bar |  | >2 bar |
|  | >70 bar |  | >3 bar |
|  | >75 bar |  | >4 bar |
|  | >80 bar |  | >5 bar |

## Master and slave Cylinder



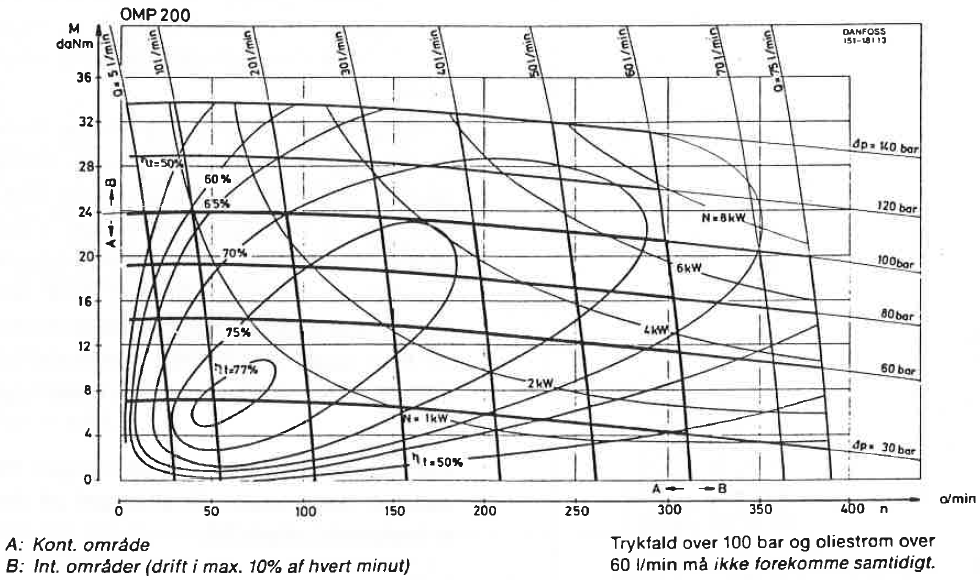
The flow into the master cylinder is 200 L/min.

The area of the piston on the master is 100 cm2. The piston rod is 25 cm2.

How fast will the slave cylinder move?

* **0,33 m/min.**
* **1 m/min.**
* **1,33 m/min.**
* **1,5 m/min.**

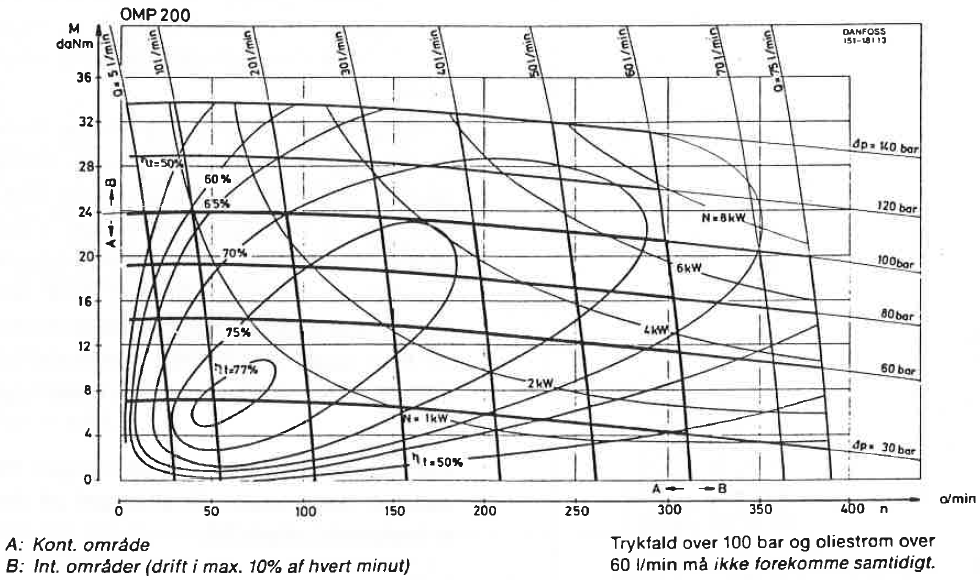
## The mussel diagram



The mussel diagram above shows a performance of a Danfoss ORBIT motor. The motor shall deliver a torque of 16 daNm. The oil flow is 40 L/min. How fast will the motor turn?

* **144 rpm**
* **175 rpm**
* **200 rpm**
* **210 rpm**

## The mussel diagram



Use the mussel diagram to answer the question.  
If the oil flow is set to 30 L/min and the system pressure is 80 bar, how much power will the motor then deliver?

* **2 kW**
* **3 kW**
* **4 kW**
* **5,1 kW**

## Motor types

The 4 drawings show different motor types. Write the drawing number next to the correct reference in the table below.

|  |  |
| --- | --- |
| No. 1 | No. 2 |
|  |  |
| No. 3 | No.4 |
|  |  |

|  |  |
| --- | --- |
| **Motor no.** | **The correct term for the motor** |
|  | Gear motor |
|  | Vane motor |
|  | Swash plate motor |
|  | Radial piston motor |

## Hydraulic symbols

The 4 drawings show different hydraulic symbols. Write the drawing number next to the correct reference in the table below.

|  |  |
| --- | --- |
| No. 1 | No. 2 |
|  |  |
| No. 3 | No.4 |
|  |  |

|  |  |
| --- | --- |
| **Valve no.** | **The correct term for the valve** |
|  | Pressure relief valve, directly operated,  internal pilot oil supply external drain port |
|  | Pressure relief valve, directly operated,  internal pilot oil supply |
|  | 3-way pressure reducing valve, directly operated, internal pilot oil supply |
|  | 2-way pressure reducing valve, directly operated, internal pilot oil supply |

## Hydraulic symbols

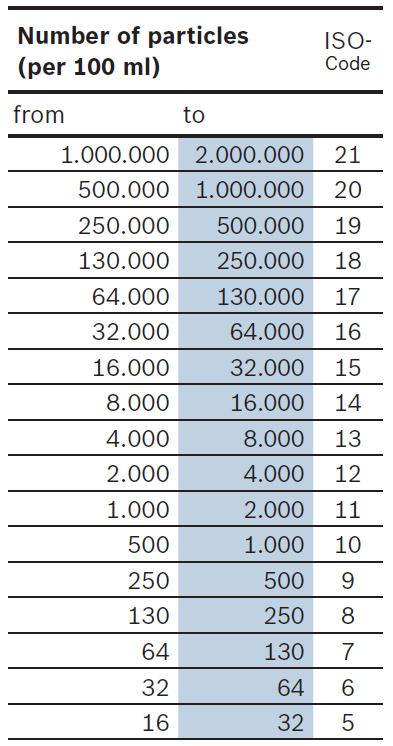
The 4 drawings show different hydraulic symbols. Write the drawing number next to the correct reference in the table below.

|  |  |
| --- | --- |
| No. 1 | No. 2 |
|  |  |
| No. 3 | No.4 |
|  |  |

|  |  |
| --- | --- |
| **Valve no.** | **The correct term for the valve** |
|  | 2-way flow control valve,  pressure compensated |
|  | Throttle check valve |
|  | 3-way flow control valve,  pressure and temperature  compensated |
|  | Flow divider |

## ISO 4406 cleanliness code

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sample no. | Particles ≤ 4 µm / 100 ml | Particles ≤ 6 µm / 100 ml | Particles ≤ 14 µm / 100 ml | ISO Code |
| 1 | 190.000 | 58.600 | 1.525 |  |
| 2 | 250.000 | 64.000 | 3.700 |  |
| 3 | 77.600 | 17.000 | 1.500 |  |



In the table above, is the result of 3 oil samples showing the number of found particles in different size.

Regarding to ISO 4406 insert the correct ISO Code for each oil sample

## Air in fluid



1

2

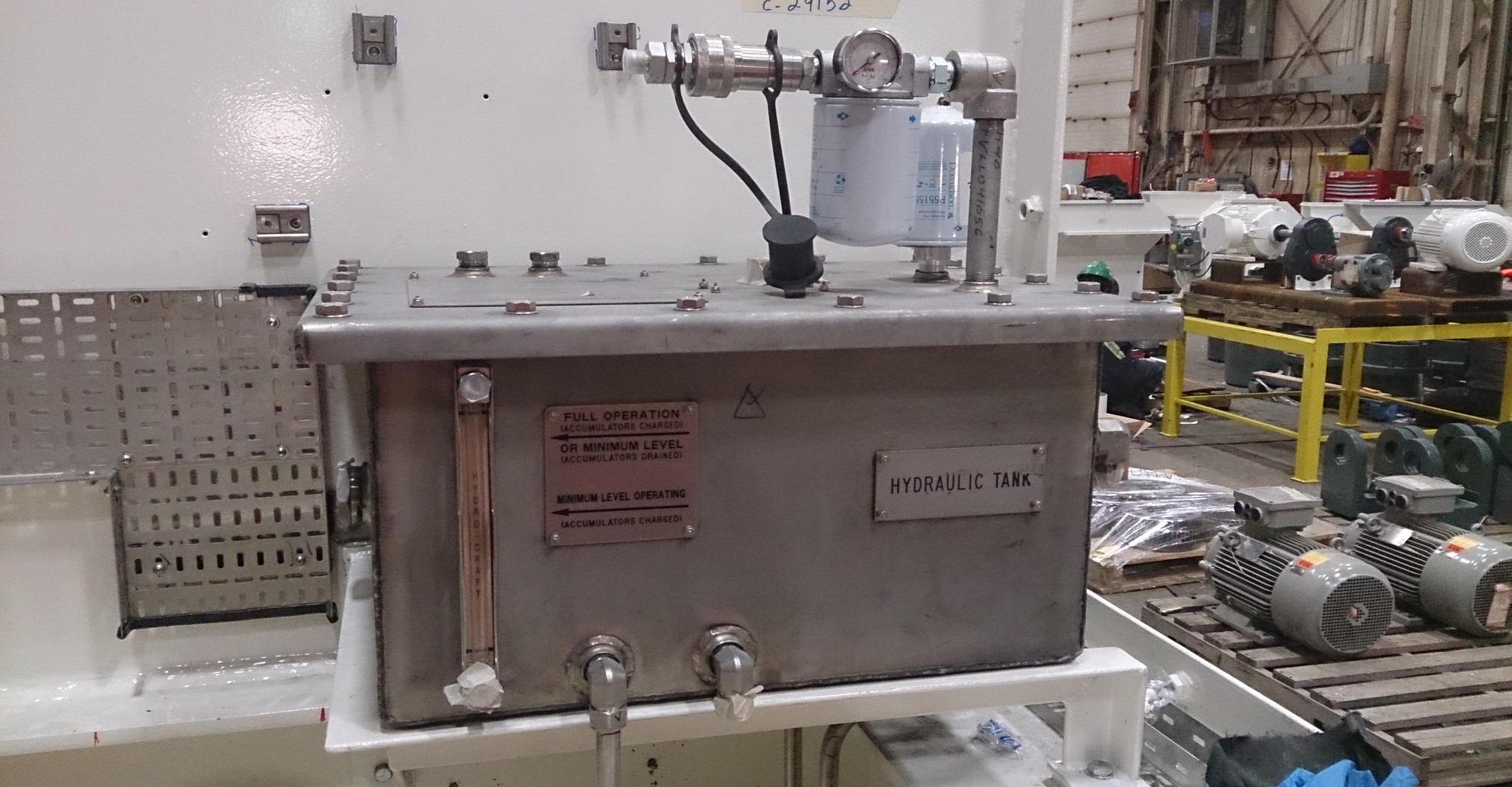
3

The 3 pictures show different kind of air in operating fluid. Write the drawing number next to the correct reference in the table below.

|  |  |
| --- | --- |
| **Example no.** | **Form of air in the fluid** |
|  | Air-in-oil dispersion |
|  | Surface foam |
|  | Dissolved air |

## 

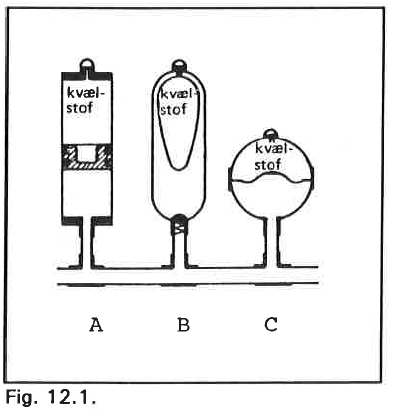
## Reservoir size



The size of a hydraulic tank for an open system should be:

* **Same size as the pump flow**
* **20 % bigger than the pump flow**
* **3 – 4 times bigger than the pump flow**
* **50 % bigger than the pump flow**

## Accumulator types



The drawing shows different accumulator types. Write the drawing number next to the correct reference in the table below.

|  |  |
| --- | --- |
| **Accumulator no.** | **The correct term for the accumulator** |
|  | Bladder accumulator |
|  | Piston accumulator |
|  | Diaphragm accumulator |

## Working range for accumulator

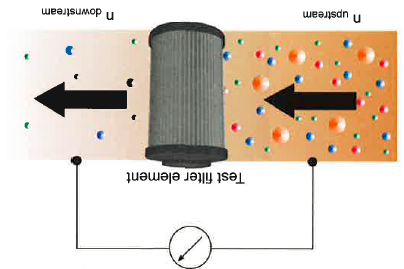
The piston accumulator is commonly used for

* **All round systems**
* **Low pressure systems**
* **Medium pressure systems**
* **High pressure systems**

## Filter performance

## Beta value

When testing the filter shown below, 100.000 particles are flowing upstream into the filter and only 1.000 particles are counted downstream.



What is the filters Beta value?

* **20**
* **75**
* **100**
* **200**

## Hydraulic cylinders

The 4 drawings show different hydraulic cylinders. Write the drawing number next to the correct reference in the table below.

|  |  |
| --- | --- |
| No. 1 | No. 2 |
|  |  |
| No. 3 | No.4 |
|  |  |

|  |  |
| --- | --- |
| **Valve no.** | **The correct term for the valve** |
|  | Telescopic hydraulic cylinder, double acting |
|  | Double acting single rod hydraulic cylinder,  adjustable cushioning at both ends of piston |
|  | Single acting hydraulic cylinder, return stroke via pressurisation, piston chamber connected to tank |
|  | Telescopic hydraulic cylinder, single acting |