

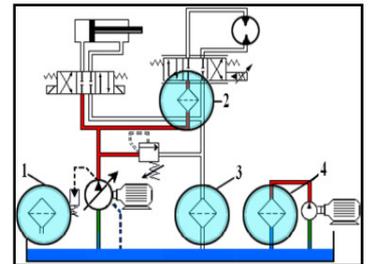
Self-Study **Sheet-7** Part-2, **on Chapter-8: Fluid Conditioning**

1- Select True (✓) or False (x) for each statement:

#	True	False	statement
1			Fluid conditioning is critical for operation of circuits. It includes filtering, temperature regulation & tank containment.
2			Hydraulic fluid that is too hot or too cold can have negative impact on hydraulic system performance.
3			Filtration has become very critical in hydraulic circuits due to more closer tolerances and finer finishes of pumps and valves plus higher operating pressures and efficiencies.
4			Proper fluid conditioning results in increased system reliability and reduced maintenance.
5			Silting is defined as tightly packing of many fine particles between valve spools and bores causing the valve to stick.
6			Engineered filtration is required to prevent silting, early component wear, and eventual failure of the hydraulic system.
7			Engineered filtration includes: understanding required micron rating, application of beta ratio, maintaining proper ISO code cleanliness levels, filter location specific to the system design and environment.
8			Ingression is defined as the rate at which external contaminants enter the system from cylinder rods, air breathers, shaft seals and other possible points of entry.
9			Micron (μm) is the designation used to describe particle sizes or clearances in hydraulic components.
10			Filter's efficiency is rated with a beta ratio defined as the number of particles upstream from filter that are larger than the filter's micron rating divided by the number of particles downstream larger than the filter's micron rating.
11			A Filter that has a large Beta ratio is more efficient than a filter that has a small Beta ratio.
12			ISO solid contamination code is universal expression used to specify the cleanliness level of 1 milliliter of any fluid.
13			ISO code is based on 1 milliliter of fluid with analysis of particle count using specific sizes of $4\mu\text{m}$, $6\mu\text{m}$, and $14\mu\text{m}$.
14			ISO code uses accurate assessment of amount of silt from $4\mu\text{m}$ & $6\mu\text{m}$ particles & amount of wear due to $14\mu\text{m}$ particles.
15			Proper placement or location of filters in the hydraulic circuit is critical for maintaining acceptable cleanliness levels, adequate component protection and reducing machine downtime.
16			Filter breathers are critical in prevention of airborne particulate ingress. Breathers filter air entering the reservoir.
17			Pressure filters are not required to protect component immediately downstream of filter such as sensitive servo valve.
18			Pressure filters must be able to withstand system operating pressure as well as any pump pulsation.
19			Return filters best provide for maintaining total system cleanliness, depending on their μm rating (Beta ratio).
20			Kidney loop or off-line filtration runs continuously & is required if fluid circulation through return filter is minimal.
21			Temperature control is critical in hydraulic systems because heat is generated whenever fluid flows from high to low pressure without producing mechanical work and if the system cannot dissipate all the heat that is generated.
22			Shell-tube heat exchanger uses air for cooling, is least expensive, very compact, noiseless, good in dirty environments.
23			Disadvantages of shell-tube heat exchangers: expensive water costs, rupture oil & water may mix, regular maintenance from mineral buildup.
24			Air-cooled H.E. has steel radiator core for oil flow while strong blast of air passes across the core by motor driven fan.
25			Advantages of air-cooled H.E. are: cooling water problems, low operation costs, dissipated heat can be reclaimed.
26			Disadvantages of air-cooled H.E. are: higher installation cost, higher noise, larger in size than comparable water H.E.
27			Reservoirs are used to: hold, cool, and condition system's oil supply by settling of solid contaminants and air removal.
28			Reservoirs may be classified as vented or open to the atmosphere type and pressurized type.
29			All oil conductor lines entering the reservoir must terminate below the oil level inside the reservoir.
30			Reservoir should include a baffle plate to prevent returning oil from entering the pump inlet without conditioning.

2- Write name of each filter, its function, position, and its function in the circuit. Select from this list: *Breather, Pressure filter, Return filter, Off-line Kidney loop filter*

Filter #	Filter Name	Filter Position in the circuit	Function of the filter in the circuit
1			
2			
3			
4			

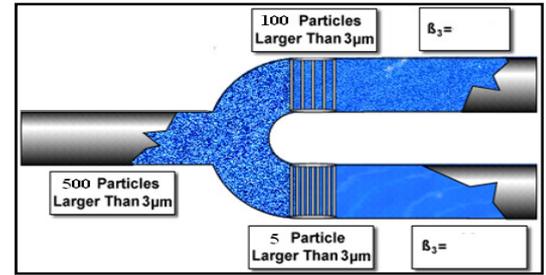


3- Define "Silting" in hydraulic systems. Show its effect on performance of valves and other components.

4- Discuss the importance of fluid conditioning & engineered filtration for operation of hydraulic circuits.

5- Define the **ISO solid contamination code** used to specify the cleanliness level of hydraulic oils & fluids.

6-Define the **Beta ratio** and show how it is used in rating the filter's efficiency in hydraulic systems. Find the Beta ratio for the two filters shown in the next figure.

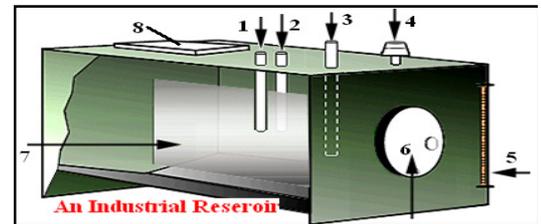


7-Explain & discuss the meaning of following:”Most servo or sliding valves require a ISO code of 15/13/12 or better, while gear pumps may operate adequately in fluids with 18/16/15 ISO code”.

8-Discuss the function and location requirements for each of the following filters: **filter breathers**, **pressure filters**, **Return filters**, and the **off-line Kidney loop filter**.

9-Discuss and compare between the designs and characteristics of **water cooled heat exchanger** and **air cooled heat exchanger**. Show the advantages and disadvantages of each type of these heat exchangers.

10-Discuss and compare between the functions, designs and characteristics of **Vented Reservoirs** and **Pressurized Reservoirs**. Show the advantages and disadvantages of each type of these heat exchangers.

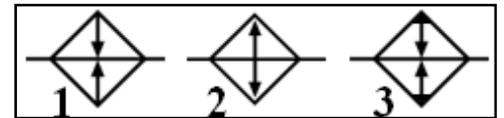


11-On the shown figure for an industrial oil reservoir, state the name and function of each part of the reservoir.

12-Write the name of each symbol and its function, and its position in the circuit. Select from this list:

Temperature controller device, heater, cooler

part #	part Name	part Position in the circuit	Function of the part in the circuit
1			
2			
3			



***** End of Fluid Conditioning *****