WIREMESH FILTER SEPARATOR
APF-WFS

APADANA PETRO FARAYAND

Knowledge is our difference

The APADANA PETRO FARAYAND filter separator provide effective, efficient, and economical removal of dust, dirt, scale, rust, and other solid foreign particles from different types of gas streams.

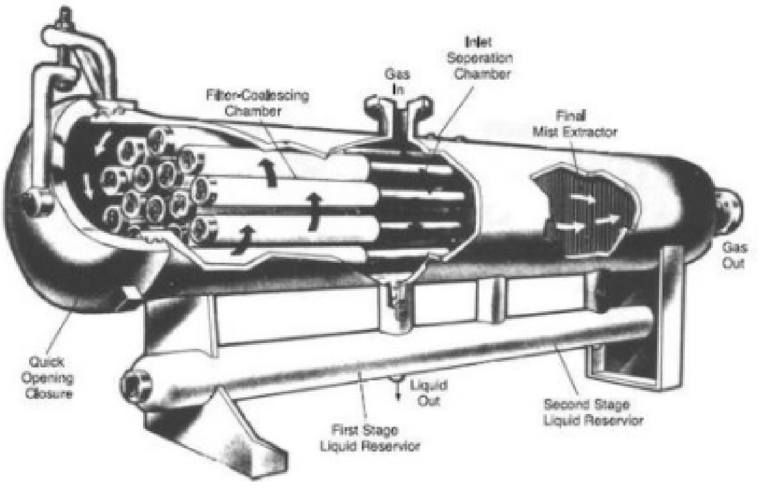
Usage

You can use a filter separator in a gas that has already gone through a demister. You can also use the device in a sensitive process for the protection of downstream equipment. Some of the common application of a filter separator include:

- **Gas distribution systems**
- **Gas storage facilities**
- **Gas compressors**
- **Metering stations**
- **Pressure reduction stations**
- **Refineries**
- **Power plants**
- **Natural gas plant**
- **Distribution pipelines**
- **Glycol dehydrators**
- **Petrochemical plants**
- **Chemical plans**
- **Desiccant bed protection**

Introduction

A filter separator usually has two parts. The first part contains filter elements while the second usually contains a vane type, swirl tube or wire mesh mist extractor. As the gas flow through filter elements, the liquid droplets coalesce into larger particle and fall to the center core. While gas moves toward second part, remaining particles removed. The second part usually contain wire mesh or vane type separator. Filter separator also contains a lower barrel for liquid storage. Separation of oil, water, hydrocarbons and solid particles in the gas stream is critical to protecting downstream equipment and can prevent major damage to equipment such as compressors and valves in downstream units. Due to the very small pores in the filter elements, this equipment also acts as a filter for solid particles.



Selection of the Best Filter Separator

For selecting the best Filter separator, these factors should be considered:

1. **Gas Stream Velocity: The internal components and configuration of the equipment should not accelerate the velocity of the gas stream once it enters the vessel. This is important to avoid the shearing of the liquid droplets into tiny drops that can easily re-entrain the clean gas.**
2. **Pressure Drop: You should select filter separators which have the lowest pressure drop across the filter elements but yet delivers efficient filtration. For vessels that operate below 500 psi, ensure that you choose filter separators that have a pressure drop of at least 1 psi or lower. Similarly, the pressure drop should not exceed 2 psi for vessels that operate beyond 500 psi. You should not choose any filter separator that has more than 0.5 psi pressure drop across the element arrangement. This pressure drop will multiply four times when the element is 50% plugged with particulate contaminants.**
3. **Service Life of the Housing: You should carefully examine the suitability of the housing for your process requirements. Selecting a high-quality vessel constructed using a durable and corrosive resistant material will last longer and give you better service. Usually, a good vessel can last between 20 and 25 years when used under suitable conditions with proper maintenance.**
4. **Performance: You should consider the level of desired filtration and the cost of not achieving it. By so doing, you can factor in the risk of exposing the downstream equipment to a certain level of a re-entrained liquid. Do the repair, maintenance, and downtime cost worth installing the filter separator you are choosing. You should make a decision based on a cost-benefit ratio associated with installing a less efficient device.**
5. **System Operating Condition: The filter separator you choose must be compatible with the process application flow rate, pressure rating, and temperature range to enable a smooth flow of operations.**

Benefits

- **Suitable for both offshore and onshore applications**
- **Can achieve 99.98% contaminants removal efficiency down to 0.3-micron particle size**
- **Enables fast and easy element replacement**
- **Easy to maintain Premium designs increase production and lower the downtime cost**
- **Does not require special tools and skills to operate**
- **Protects system components from damages due to efficient filtration**
- **Safe to use**
- **Saves on installation space**
- **Can operate under harsh conditions because of quality construction materials**

Material of Construction

The material for constructing the medium for a separator will depend on the type of liquid droplets you want to remove. The material for constructing the coalescing element should attract the liquid droplets to ease the amalgamation process. When constructing a medium for removing water droplets, you should go for hydrophilic material such as fiberglass and stainless steel. However, when you want to remove light weight hydrocarbon contaminants such as oil, then you should select oleophilic material such as polypropylene and fluoropolymers. However, the process gas is usually contaminated with both water and oil impurities. Hence, some of the most suitable and high performing media comprises a mixture of both oleophilic and hydrophilic materials. Furthermore, such medium comprising of different materials with diverse properties are usually more effective due to synergy compared to the single-material medium. You can also use nylon, micro-glass, and polyester. Fiberglass is the most common type of medium because the material is widely available and is cheaper.

Filter Elements

A cartridge filter consists fiberglass as a filter material. A perforated support body ensures optimum strength and perfect protection for the filter fleece. The filter element can filter out very fine dirt particles of 3 to 50 microns. Due to the large surface, the filter elements are capable to eliminate contaminate with a low-pressure loss, high-volume flow and long service life. Flow of the gas is from the outside to the inside of the filter cartridge. Thus, the contained dirt particles remain adhered to the surface of the filter medium. The cleaned gas is discharged from the filter cartridge and returned to the system. The pressure drop in the filters is due to two phenomena. Pressure drop due to fluid passing through the filter and pressure drop due to solid remaining on the filter. The following equation illustrates this point.

$$\Delta P = \Delta P_r + \Delta P_s$$

To estimate each of these two parameters, there are many equations. One of them has shown below.

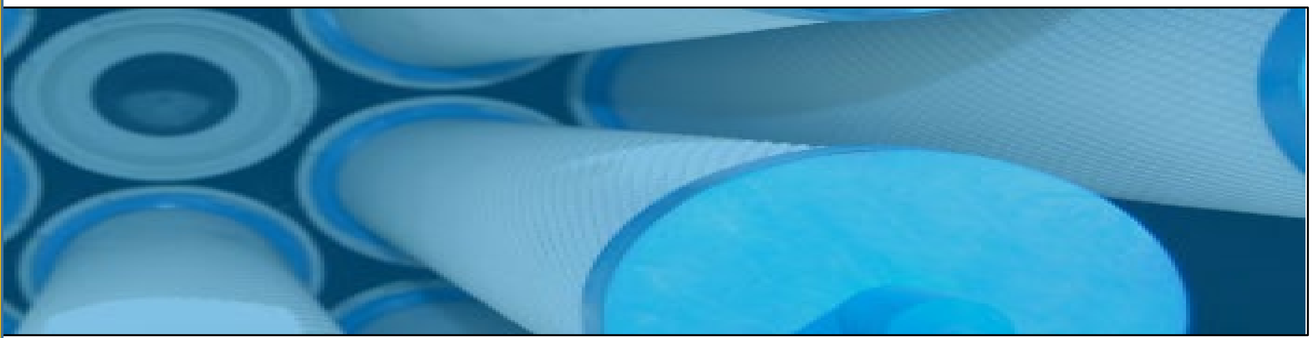
$$\Delta P_r = K_r \eta \upsilon$$

$$\Delta P_s = K_s \eta h(t) \upsilon$$

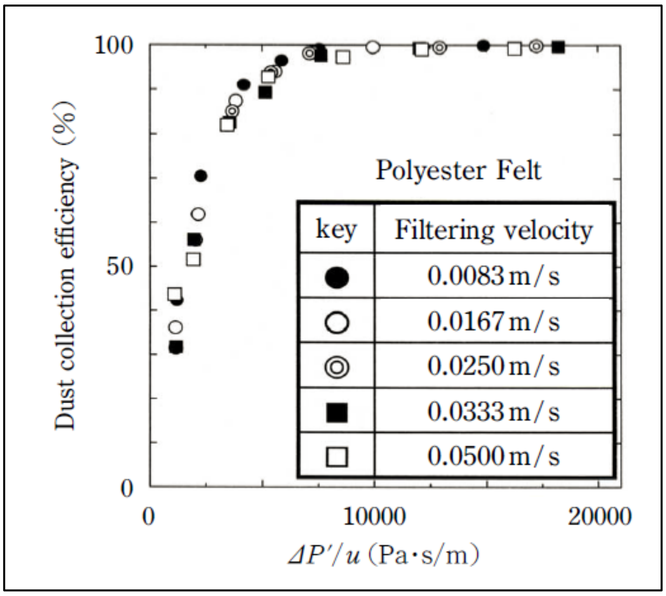
In the above equations, K_r and K_s are the coefficient of resistance of the filter and the solid respectively, η is the dynamic viscosity of the gas, υ is the velocity of the gas inside the filter and h(t) is the solid thickness left on the filter. The K_r and K_s coefficients are available in handbooks and articles. Very few studies have been performed on changing the efficiency of the filter by increasing the residual solid on the filter. In one of these studies, the change in efficiency of polyester filters in terms of pressure drop is expressed as the following equation.

$$\eta = 1 - \exp\left(-1.36 D_p^{\frac{2}{3}} \left(\frac{\Delta P}{u}\right)^{\frac{6}{5}}\right)$$

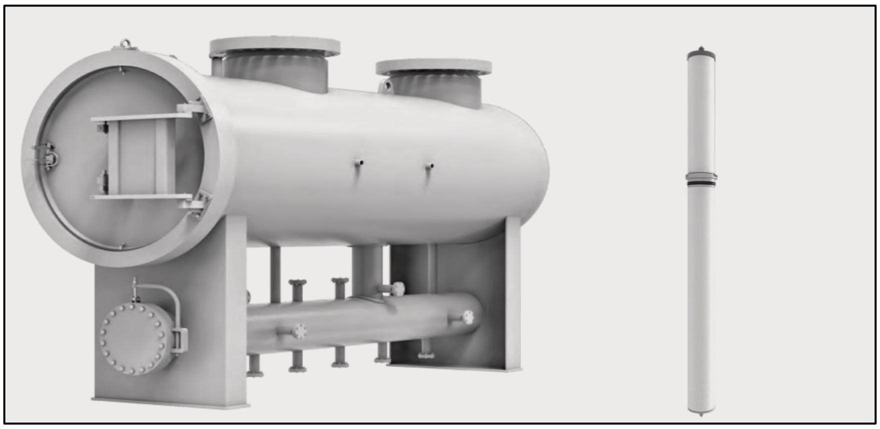
In the above equation, D_p is the particle diameter in meters, ΔP is the filter pressure drop in Pa and u is the filtration rate in m/s.



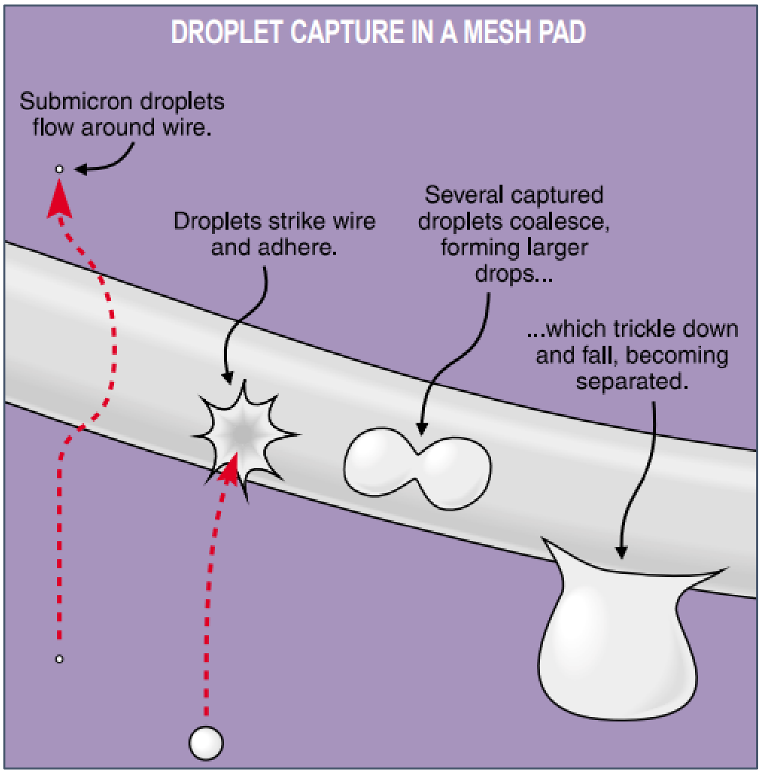
As an example, for a particle size with a diameter of 0.4 microns, the efficiency change diagram with respect to the change in the ΔP/u parameter is shown in the figure below. As can be seen, the efficiency value for ΔP/u greater than about 10,000 is equivalent to 1. Typically, filtration speeds in industrial units are 0.1 meters per second and the minimum pressure drop is equivalent to 2 psi. Thus, the minimum ΔP / u in industrial units is 137895 Pa.s/m. Thus, in industrial units, the efficiency for all values of pressure drop depending on the particle size is about 1. After using the filter for a while, a layer of solid covers the surface of the filter, and this solid layer helps to improve the efficiency of the filtration.



In APF-WFS filter separator designed by APADANA PETRO FARAYAND, wire mesh is used as the second part of separation. Wire mesh mist eliminators provide a high separation efficiency at the lowest installation costs. They are usually comprised of multiple, compressed layers of thermoplastic or metal wire, and deliver excellent results over a broad range of gas/liquid separation tasks. When the gas with liquid drops rises at a certain speed and passes through the knitted wire mesh mist eliminator, the small openings of knitted wire mesh will prevent the drops passing through and inertia of the rising drops make them collide with wire mesh and then adhere to the surface of the wire mesh. The drops on the wire mesh surface will diffuse and subside.

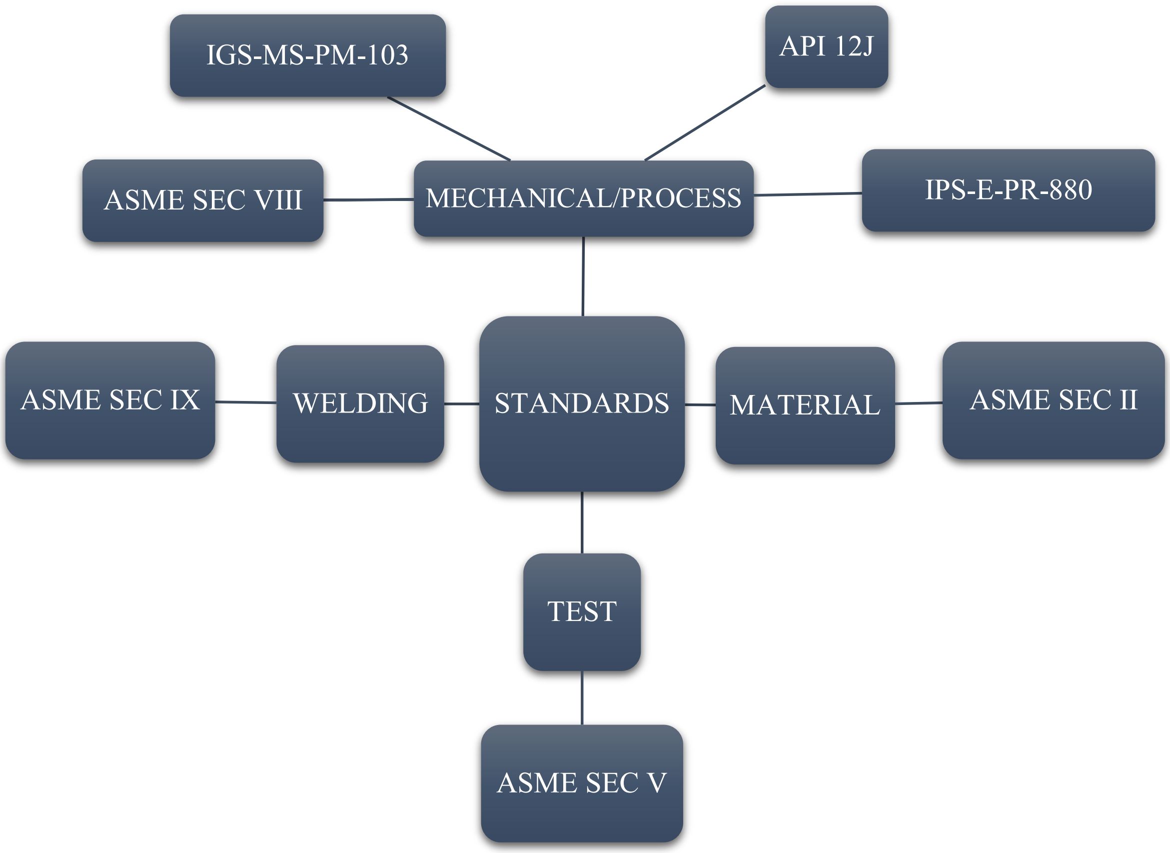


Proper separation in wire mesh depends on their proper design. The main parameter in the design of this equipment is the speed of the gas passing through it. If the speed of the gas passing through the wires is too high, the entrainment phenomenon occurs. In this phenomenon, liquid droplets accumulated on the wires are being removed from the wires surface due to the high speed of the gas and get out of the tank with the gas flow. One of the most widely used equation to calculate the maximum allowable gas velocity passing through a wire mesh is the one by Souders-Brown. The constant value of K in this regard is mentioned in various sources. This amount also depends on the operating pressure of the system. The most widely applicable type of mist eliminator is made of metal or plastic wire with typical diameter of 0.006 to 0.011 inch. In the most familiar application of knitted mesh, the crimped strips are stacked to form a pad with typical thickness of four or six inches. Rigidity is provided by a frame usually metal consisting of a grid on each side and rods passing through the mesh. Mesh pads can be made in almost any shape, but most are round or rectangular.



Souders-Brown Equation $$V_G = K\left(\frac{\rho_L - \rho_G}{\rho_G}\right)^{0.5}$$

STANDARDS


IGS-MS-PM-103
API 12J
ASME SEC VIII
MECHANICAL/PROCESS
IPS-E-PR-880
ASME SEC IX
WELDING
STANDARDS
MATERIAL
ASME SEC II
TEST
ASME SEC V

Mechanical features

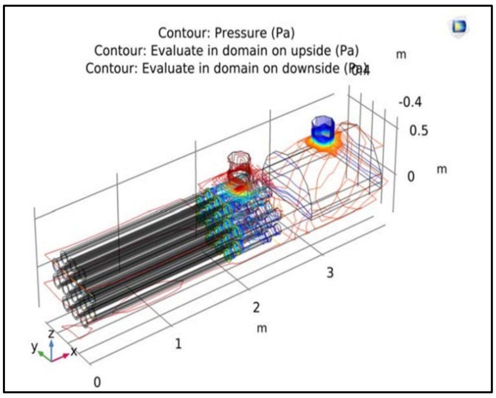
- ASME type quick opening closure
- Safety opening system
- Level, pressure and differential pressure gage included
- Inspection openings
- Vent and drain valve included
- Low pressure drops
- Self-supported and lifting lug included
- Long life ‘O’ ring sealing design
- Standard class rating ASME 150,300,600

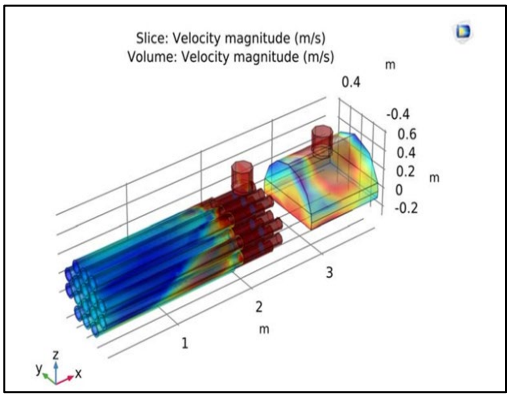
Optional features

- Design for specific capacity, pressure and temperature
- Design class rating ASME 900,1500,2500
- Design for sour gas and corrosive fluid
- Use of level switch, level alarm, differential pressure alarm, automatic drain system

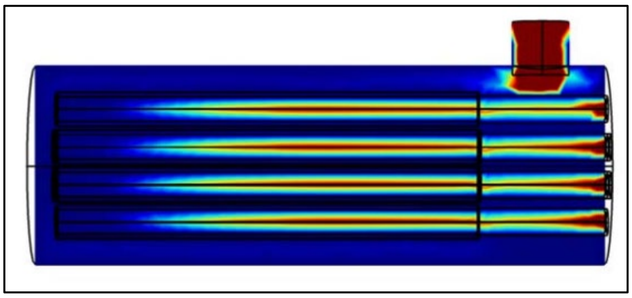
Knowledge is our difference…

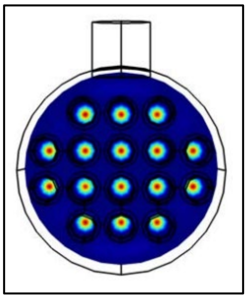
We believe that investment on research and development is an essential component for long term success. Computational Fluid Dynamics is a reliable tool for design optimization, troubleshooting, and product development. Flow distribution is critical in all gas-liquid and liquid-liquid separation vessels. As vessel sizes are reduced or more capacity is expected from existing equipment, traditional design rules for vessel geometry and flow distribution must be reviewed for all elements that can affect separation performance such as flow velocity through inlet and outlet nozzles, spacing between nozzles, internals and liquid levels. CFD modeling is used by engineers at APADANA PETRO FARAYAND to simulate flow conditions and vessel geometry. The modeling provides a close approximation of the fluid flow profile inside the vessel.



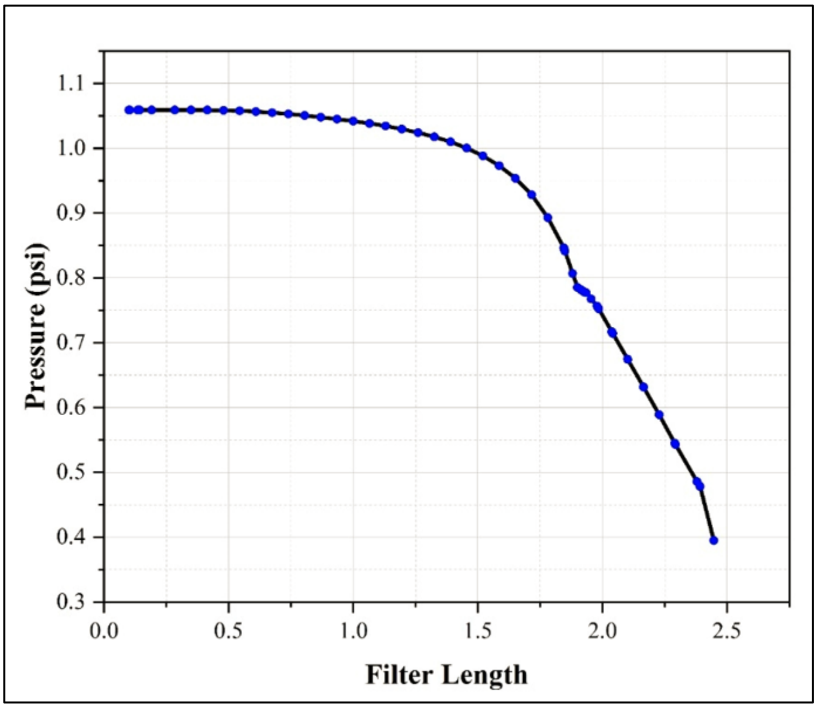


In the pictures below, using COMSOL software, velocity contours are shown along the length and cross section of the filter elements.

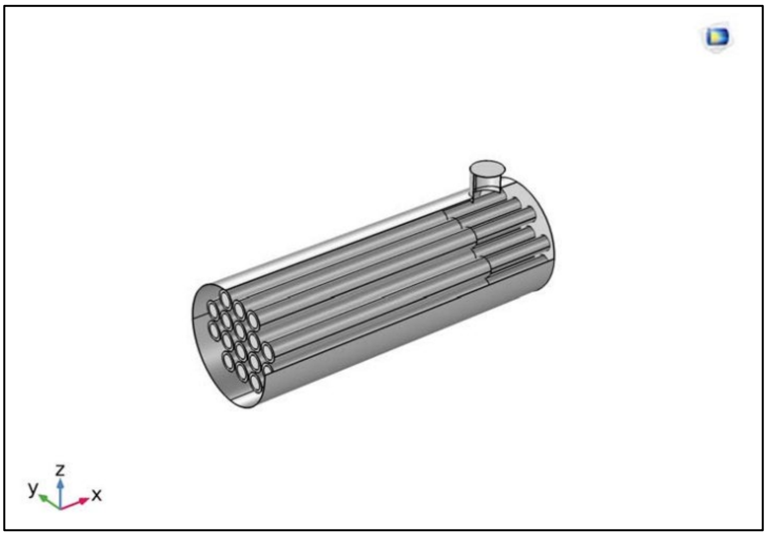




The following picture shows the pressure change diagram in terms of element filter length using COMSOL software.



The following picture shows geometry of filter element part, made by COMSOL software.



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