DRY GAS FILTER

APF-DGF

APADANA PETRO FARAYAND

Knowledge is our difference

The **APADANA PETRO FARAYAND** dry gas filter is equipped with high-efficiency synthetic cartridges and offers an efficient method of filtering small-to-moderate quantities of solids to protect essential equipment in pipeline applications.

Usage

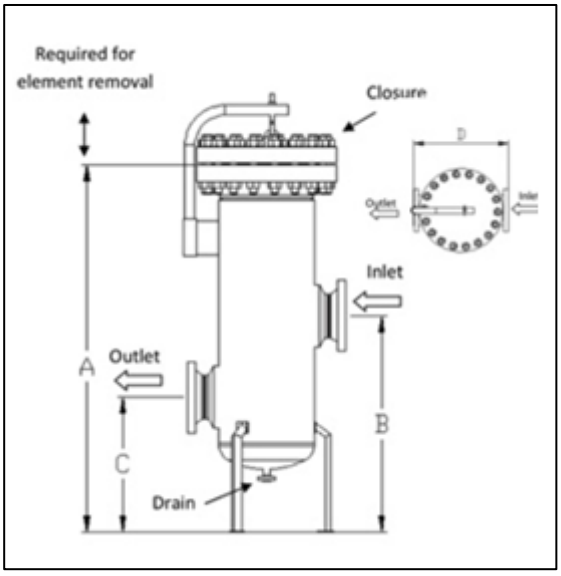
- Downstream of dry desiccant beds
- Downstream of catalyst beds
- Metering and gate stations
- Fuel gas to compressors
- Protection of regulators and valves

Suitable for Filtration of

- Catalyst fines
- Desiccant particles
- Dust
- Pipeline scale
- Sand and silica

Introduction

Sometimes solids are present in the pipeline or gas stream, but there are no liquids or aerosols. In this case strainers or dry gas filters are recommended to remove small particles. If the level of contaminant in the gas stream is fairly low, an inline filter will suffice. Dry gas filters use filter elements to remove solid particles by direct interception or inertial impaction. Generally, pleated elements of a synthetic media such as polyester are used. Various combinations of cellulose and fiberglass cartridges are also available. The gas in in-line dry gas filters generally flows into the center of the element and then to the outside of the element and to the outlet nozzle. In the standard vertical or horizontal dry gas filter the gas flows from the outside of the element to the inside of the element prior to exiting through the outlet nozzle. Various efficiencies down to one micron and lower are available based upon the design and element efficiency. Generally, dry gas filters are applied in gas plants downstream of molecular sieves and in distribution systems. Upstream of natural gas plants there is normally a liquid in some form present, so a filter-separator designed to handle liquids or a filter-coalescer is a better choice. Though most cartridges used for dry gas filters are pleated, if the solids are deformable, like a wax, or shear sensitive like iron sulfide, then a depth element should be considered in place of the pleated elements mentioned above. These depth elements are generally used in vertical or horizontal dry gas filter and not the in-line design. With a properly designed and applied depth element, iron sulfides down to 0.3 micron can be removed.



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.

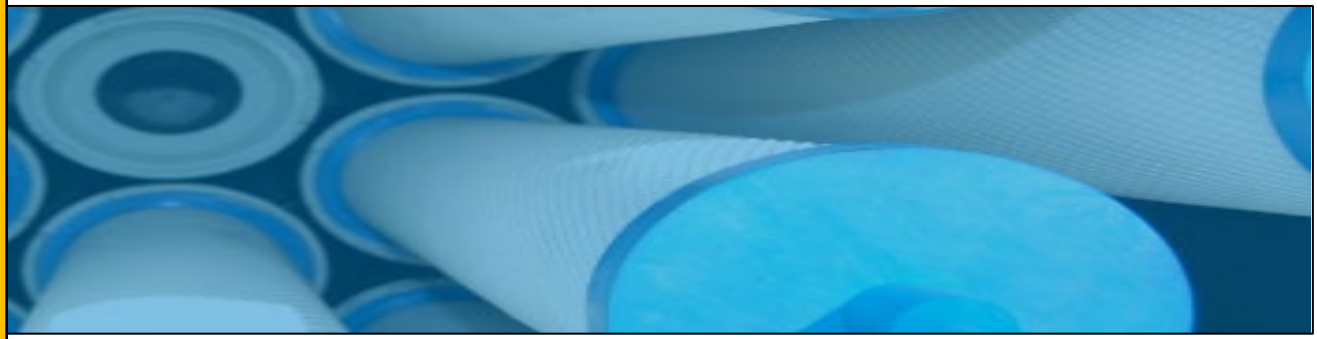
$$\Delta P_r = K_r \eta \upsilon$$

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

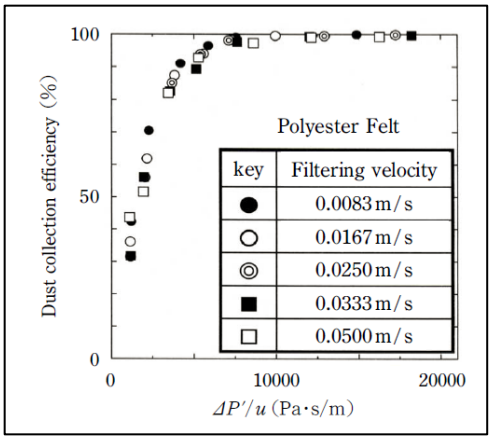
In the above equations, K_r and K_s are the coefficient of resistance of the filter and the solid respectively, η is the dynamic viscosity of the gas, υ is the velocity of the gas inside the filter and h(t) is the solid thickness left on the filter. The K_r and K_s coefficients are available in handbooks 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 drops 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.



Separation Efficiency

Generally, dry gas filters are highly efficient state of the art devices. Nevertheless, the degree of efficiency of the dry gas filters still varies with the contaminant sizes. Therefore, it means that when extracting large particles, the equipment would quickly achieve a top-notch filtration level. Conversely, the efficiency decreases with smaller micron-sized particles. In particular, the device achieves 100% efficiency in the removal of solid particles sized of about 3 microns and more. However, for 1 to 3 micron-sized contaminants, the efficiency clocks 99%. That is with a corresponding reduction when dealing with less than micron-sized particles.

Gas Media

The dry gas filter does not purify any kind of gas media. Take a look at the following working media of the dry gas filter:
Natural gas, Propane, Ammonia, Ethylene, Methyl chloride, Propylene, Biogas, Ethane, Helium, Air, Carbon Monoxide/ Carbon Dioxide, Methane, Hydrogen, Halocarbons.

Advantages

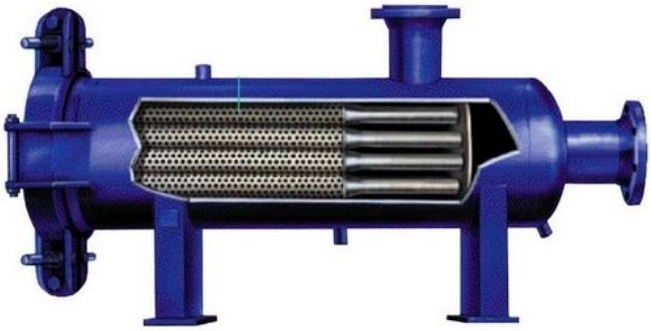
- High separation efficiency
- Onshore and offshore application
- Outdoor installation
- Safe operation
- No need to particular kind of specialized training
- Replacing the filter cartridges is quick and easy and no complicated procedures
- Easy cleaning and maintenance

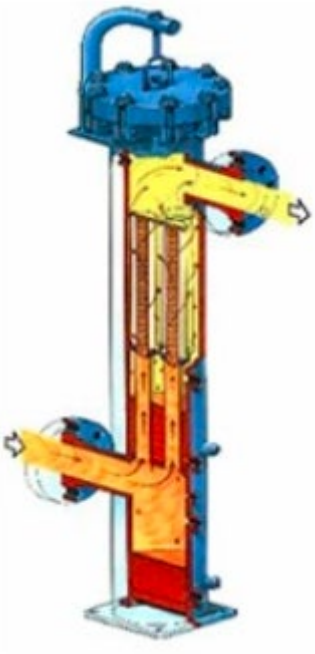
Different part of dry gas filter

- Pressure indicator gauges
- Filter housing- forms the outer covering of the whole filtration system.
- Filter Support grids- to position in place the filter housing.
- Inlet and outlet nozzles
- Vents
- Drains
- Opening valves
- Flanges and gaskets connections
- Bolts

Along with specific customer requirements some of the many options available are:

- Horizontal and vertical designs
- Custom nozzle orientation
- Quick-opening closure
- Skid mounted
- Lifting lugs valve and control packages





Selection of Suitable Dry Gas Filter

Selecting a dry gas filter is one of the essential aspects that you have to take with a lot of precision. when selecting the dry gas filter, be keen to consider the following critical factors.

1. **Cartridge Filter Integrity:** The cartridge filter should reveal structural integrity capable of preventing the flow of gas through the unfiltered outlets. The filter should be highly efficient and, if possible, to have a dual-core that is the inner and outer core.

2. **Pressure Drop:** You must comprehend the significance of the pressure drop across the cartridge together with the element. The pressure drop is particularly essential whenever you size filters. Exclusively, you may consider the elements which have a low-pressure drop at high efficiency. You need to also enquire about the collapsing pressure drop value and the varying range of pressure drop during operation.

3. **Efficiency:** The extent of efficiency will determine the overall filtration achievement in extracting contaminants from the gas. Depending on the level of impurity of your gas, you have to select the most efficient filter. The key aspects to consider comprises of the particle size of contaminants present in your gas.

4. **Collapsing Rating:** You have to importantly consider the differential pressure across the filter media, which can potentially trigger the failure of the element. Such value is the collapsing rating. For instance, the filter elements with a bypass-valve do have a collapsing rating almost twice higher than one with a full-flow bypass-valve.

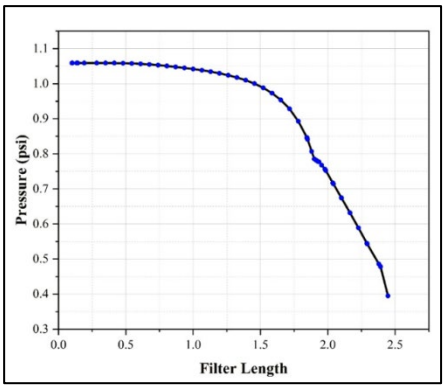
5. **Contaminant-Holding Capacity:** Contaminant holding capacity is also known as the dirt holding capacity. Critically, always check the highest quantity of contaminants a filter media can sustain without hampering its filtration efficiency. The value varies according to the filter type and the size of the filter system. The manufacturer should provide such a rating because it determines the filter life span before the need for replacements.

6. **Gas System or Application Requirements:** More importantly, you have to consider your overall gas system facility requirements. Having known such essential needs, you should then settle on a perfect dry gas filter. Do not leave out the application requirements. Such information will consist of the location of your facility, flow rates, vibrations, expected contamination levels, etc.

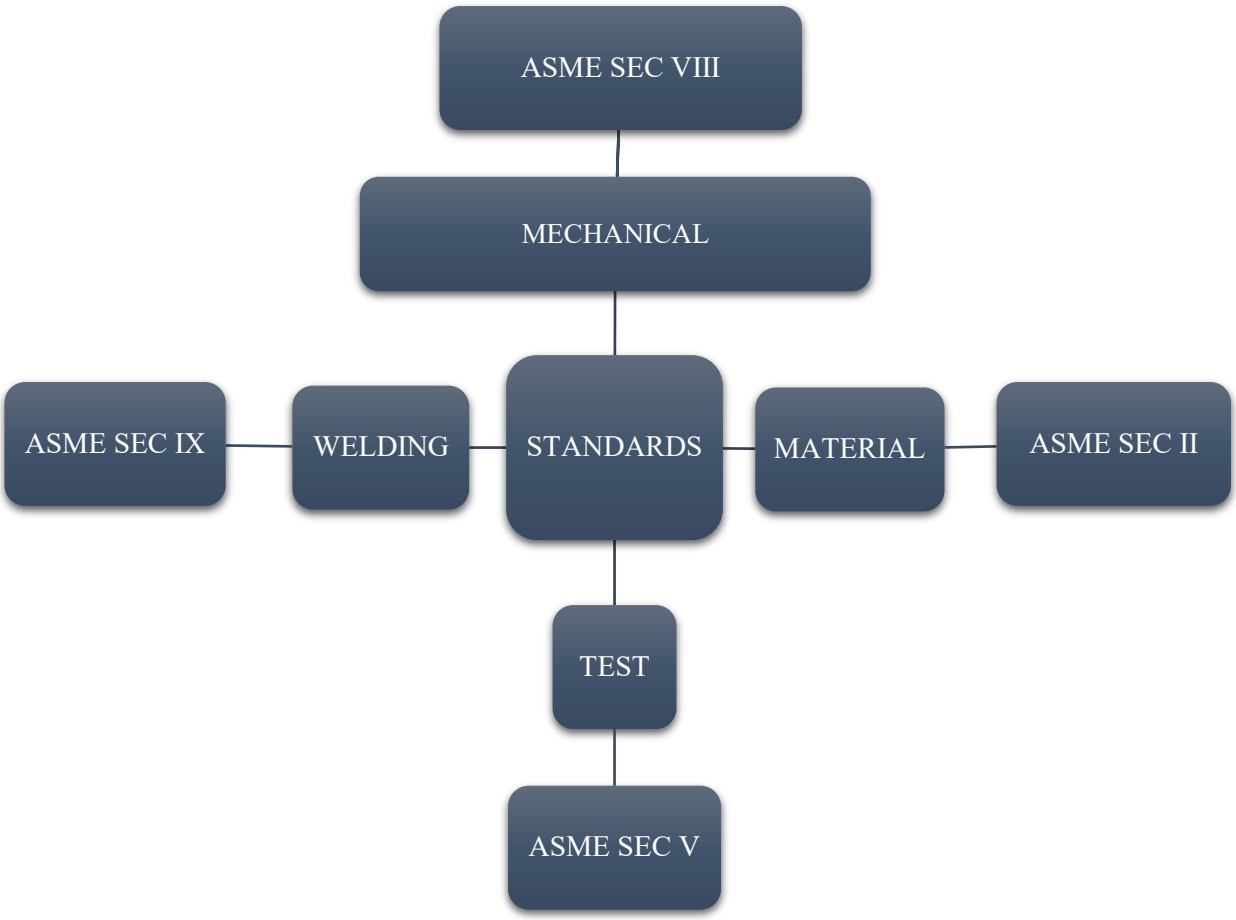
7. **Type of Operational Media:** When you specify the exact type of gas you intend to clean, then your chances of acquiring a perfect filter are high. Different gases exhibit different chemical and physical traits. Some gases may be corrosive, others mild, some neutral while others are excessively corrosive. Again, different types of gases contain several degrees and sizes of contaminants. Most importantly; This critical information should be adequate in informing your choice of unique system requirements for your filter, which corresponds to your applications

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



STANDARDS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