Facet International
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Air/Gas Filtration and Separation General Description

Definition

Air/gas filtration may be defined as the art of removing solid particulate matter from dry air/gas streams to free the stream of dust and other abrasive solid particulate matter. Air/gas filtration and separation may be defined as the art of removing solid particulate matter and liquids in suspension in air/gas streams. The field of air/gas filtration and separation filtration is one of a combination of removing either solids, or solids and liquids such as water and hydrocarbons, which may appear as slugs or in the form of mist or fog.

The above may be considered entrainment separation and while water or hydrocarbons may appear in an air or gas stream in a vapor form, the term entrainment separation would not apply to the removal of such contaminants in a vapor form. This removal would be properly classified under the category of dehydration which is sometimes referred to as purification. Entrainment removal will not lower the dew point of a gas stream; this can be accomplished only by vapor removal.

How Air/Gas Equipment Functions

The filtration of air/gas products is accomplished by passing the air or gas through a suitable filter media which permits the passage of the air or gas but retains the solids. This is a pure function of filtration identical to that of filtration of liquids, and is generally used only in cases of dry air or gas streams. However, solids may be removed in the presence of liquid entrainment, but the specific term “filtration” should not imply the liquids will be removed.

The filtration of air or gas may be further expanded by the use of an impingement baffle in the housing which would cause the knockout of coarse solids and entrained water or hydrocarbon. After the baffle, the air or gas then flows through a filter media which removes the finer solids; however, any remaining water or hydrocarbon after the baffle would pass through such a media. Air/ gas entrainment filtration separation is accomplished by passing the product through a suitable first-stage baffle, then through the second-stage coalescer cartridge which coalesces the water and hydrocarbons and removes the solids prior to entering the third stage. The third stage is a cartridge very similar to that of a filter cartridge except that special treatment makes it a water and hydrocarbon repellent member and causes the cartridge to repel discrete droplets of both water and hydrocarbons. It is important that a large quiescent area be provided in the sump for the entrainment separator to function properly.

This permits the impinged droplets to fall out before they might be carried into the stream.

In cases of large gross amounts of solids, it is advisable to install a prefilter section in the housing to remove the gross solids, thus permitting the second-stage coalescer cartridge to remove only the finer solids and coalesce the water and hydrocarbons.

General Applications

- Removing solids and water which may damage gas-measuring equipment.
- Protecting dry bed desiccant towers from free water, oil distillate, etc.
- Removal of liquids and solids from fuel gas lines. Cleaning and conditioning charge stock in synthesis plants.
  Example: Anhydrous ammonia synthesis using natural gas as a charge stock.
- Removal of free liquids and solids at inlet to compressor stations and between compressor stations. On compressor discharge to remove lubricating oil.

Selection Of Equipment

The selection and size of equipment required to remove solids, water or hydrocarbon mist or fog from air or gas streams will depend on the flow rate, operating conditions, and physical characteristics of the gas. It is necessary to remember that any effective equipment must be designed to remove the desired amount of solids and other contaminants in one pass at full flow.

The amounts and types of solid and liquid contamination to be removed will have a bearing on the type of equip- ment and type of media selected. The location of the equipment also becomes a factor since proper operation of equipment frequently demands regular attention.

A basic fundamental in the selection of this type of equipment is the manufacturer’s history of ability to upgrade media that will be interchangeable with the original media. In other words, is it possible to use cartridges with recently developed media that are dimensionally interchangeable with the cartridges originally purchased with the equipment? If so, no housing modifications are necessary to take advantage of advances in the state of the art. Facet standard cartridge dimensions permit such upgrading.

Due to our continuing program of improvement, specifications are subject to change without notice.

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Cost of Operation

Cost of operation of air/gas filtration and separation equipment is based primarily on operating costs. Original equipment costs should be secondary. Filtration and separation equipment has a long life so reasonable differences in acquisition costs, apportioned over a long life, become minor factors in cost.

The true cost of operation is based on the cost per pound of solids or cost per gallon of liquids removed from the air or gas. Thus five factors make up the cost of operation:

1. Cost of media (cartridges, etc.)
2. Cost of service parts (gaskets, etc.)
3. Cost of maintenance labor
4. Cost of downtime to service or maintain (value of lost production)
5. Horsepower requirements versus ΔP

By accumulating the total of these five factors, a cost per unit may be arrived at on several bases, such as pounds of solids or gallons of liquid removed per million cubic feet of gas (month, year, etc.)

Design Criteria

Complete data is the prerequisite of any good design criteria. Therefore, all flow conditions, amounts of contamination, solids or liquids, operating pressure, operating temperature, and desired efficiencies all become an integral part of the data necessary for the adequate sizing and design of the proper equipment.

In designing a filter or an entrainment filter separator for air or gas, consideration must be given to the types of solids to be retained. As an example, consider the density of the solid with regard to the number of cartridges needed to hold a given volume of solids. It requires fewer cartridges to retain a given weight of a dense solid than is required to retain the same weight of a solid of lesser density. Also, particle size distribution affects the design by aiding in determining the volume of solids the specific cartridge can be expected to retain.

Capabilities

Over fifty years of experience in the process industry and in the removal of solids and water from aviation fuels has led to Facet's development of the media and housing designs needed to cope with the increasing demands for filtration and liquid removal from air and gas streams.

Facet's pipeline and out-of-storage experience can be used to a great advantage in gas transmission and out-of-cavern operations in the gas industry. This, coupled with our experience in all types of filter applications, also provides the basis for handling in-plant applications of processing plant air for use on compressors and all types of air operations.

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