How to Select a Pipeline Strainer

Three Design Criteria for Proper Selection

By: Chris Pasquali, CEO Factory Direct Pipeline Products, Inc.

Selection of the best pipeline strainer will contribute to the longevity of the piping system and enhances the quality of the product or process while minimizing maintenance requirements.

Three Criteria for proper pipeline strainer selection

1. Choose the proper strainer configuration
2. Identify critical design criteria
    a. Select the materials of construction
    b. Determine the correct particle retention size
    c. Choose a strainer size based upon fluid velocity and differential pressure
3. Identify installation space constraints

Strainer Configuration

There are several basic types of strainers and thus the first step is determining which style will work best for your application.

Y Strainers

Typically applied when the amount of particulate to remove is small because compared to other strainer designs their holding capacity is significantly less. This type of strainer is also commonly used when frequent cleaning of the element isn't necessary, which implies the particles removed consist of harder, coarse materials that can be drained from the element and that the particulate is not wedged into the element openings which would require manual cleaning. Y strainers have an advantage in that they can be installed both horizontally and vertically with a downwards flow orientation.

Simplex Basket Strainers

Having a single straining element, these are used for batch processes or when the process can be shut down to enable accessing of the element for cleaning. Simplex strainers are the most common type of strainer where element cleaning is relatively frequent because they are designed with oversized elements that are easily accessed and cleaned.

Duplex Basket Strainers

Duplexed designs have two elements and designed for applications which require element cleaning without shutting down the process. One chamber is in service while the other is isolated and the determination of which basket is isolated and which is in service is made via a manually operated diverting valve. The valve designs used for diversions range from several ball or butterfly valves operated in a distinct sequence to valves that are linked together to a single actuator.

Automatic Self-Cleaning Strainers

These are used for applications when manual cleaning is not convenient or practical, which can be the case if the need for cleaning is frequent or the installation is located in a difficult-to-reach location. Particulate accumulates on the surface of the element and is purged from the strainer via the differential pressure of the system compared to atmospheric pressure or whatever the pressure required for the backwashed fluid to move from the strainer body. A small portion of the filtered fluid is used during backwashing and the process itself can last from one second to a few minutes depending upon design and strainer size.

Temporary Strainers

Referred to as cone or basket strainers and sometimes "witch hat strainers", these fabricated products are designed to be inserted within a flanged pipe spool. Temporary strainers are used for start-up of fluid systems, either after major retrofits or for entirely new systems where there is potential for construction debris to be removed from the pipeline. Since they are not easily accessed, they are normally removed prior to production.

Pipeline Strainer Design Criteria

Pipeline strainers can be custom fabricated to have multiple connections and ports, made from exotic alloys, have custom coatings and engineered to meet specific design criteria involving differential pressure, flow velocity and particle holding capacity.

Materials of construction

The best practice is to provide a strainer made of the same material as the pipeline, especially when the temperatures are extreme or fluctuate because different materials have different coefficients of expansion. Corrosive fluids can be handled several ways; exotic alloys, linings/coatings and engineered non-alloys are all options to explore. In addition to the initial cost, each configuration will have different element designs and flow characteristics.

Particle Retention Size

Pipeline strainers are used to protect downstream equipment or processes from particulate, thus to ensure efficient removal the acceptable level of particle size and the performance tolerance must be established. Pipeline strainers are used for macrofiltration applications where the retention efficiency is "nominal" or "approximate".

Pipeline strainers are not designed for microfiltration applications requiring specific efficiencies. Such "absolute" efficiencies are defined by engineered particle testing and establishment of a Beta Ratio – characteristics of our filter cartridge and bag filter designs.

It is commonplace to establish the element retention of pipeline strainers to be 1/4 to 1/3 of the maximum accepted particle size. The idea is to retain the required particle size without being too aggressive and "over filtering", which simply increases the frequency of element cleaning. Since many pipeline systems have areas of low velocities, such as between spray nozzle ports, smaller particulate can accumulate in these low velocity areas, clump together and become problematic. This is one reason why it is desirable to install strainers and filters as close to the area to be protected as possible and much depends upon the physical characteristics of the particles within the system and the amount of them.

Particle Sizes for Strainers & Filters

U.S. Mesh	Perf.	Inches	Microns	MM
-	1	1.0000	25400	25.400
-	3/4	.7500	19050	19.050
-	5/8	.6250	15875	15.875
-	1/2	.5000	12700	12.700
-	3/8	.3750	9525	9.525
-	1/4	.2500	6350	6.350
-	3/16	.1875	4763	4.763
-	5/32	.1500	3810	3.810
-	9/64	.1406	3571	3.571
-	1/8	.1250	3175	3.175
-	3/32	.9375	2381	2.381
-	1/16	.0700	1778	1.778
20	1/32	.0331	841	.840
30	-	.0232	595	.590
40	-	.0165	420	.420
50	-	.0117	297	.297
60	-	.0098	250	.250
80	-	.0070	177	.117
100	-	.0059	149	.149
150	-	.0041	104	.104
200	-	.0029	74	.074
325	-	.0020	50	.050
400	-	.0015	38	.038
-	-	.0009	25	.025
-	-	.0003	10	.010
-	-	.0001	5	.005
-	-	.00004	1	.001

Pipeline Strainer Range

Filter Bag & Cartridge Range

Filter vs. Strainer

Relative element holding capacity is estimated by the ratio of open area, which is the comparison of the total open area of the element to the cross sectional area of the inlet pipe. This figure varies from 2:1 to 6:1 depending upon the strainer design.

We provide free, no obligation fluid testing to establish the particle size range and concentration for critical applications; given a small sample of your fluid, such an analysis helps us ensure the strainer or filter is properly sized.

Fluid Velocity and Differential Pressure

Although it differs slightly with the particular strainer design, the target fluid velocity through a pipeline strainer ranges from 3 to 8 FPS with more viscous fluids operating at the lower end of the velocity range. As our article Fluid Velocity and Differential Pressure describes, fluids can be transferred within pipelines at higher velocities however it is often detrimental to critical aspects of strainer element performance when the velocity through the screen exceeds 8 FPS.

Differential pressure increases exponentially because at some point the open area of the element is less than the cross sectional area of the inlet pipeline due to particulate accumulation. Thus our sizing guidelines strive for an initial clean differential pressure of ≤ 2 PSI with the prompt for element cleaning after the differential pressure increases by approximately 5 PSI, which should afford sufficient time to access the vessel and clean the element. Burst differential pressure of an element, which might be within a 20 to 30 PSI range, does not mean that deformation and thus inability to properly seal will not happen at lower pressures. Likewise fast acting valves downstream of the strainer could contribute to "water hammer" pressure spikes. The "water hammer" aspect is particularly problematic with non-alloy strainers and discussed in detail in our article Water Hammer Considerations for Plastic Valves and Strainers.

Always determine the strainers pressure class based upon the highest possible pressure and temperature, usually referred to as the design pressure/temperature.

Physical Location

Access to the strainer element is a key consideration; it should be safe, ergonomically accessible and have the proper clearances for removing the strainer element. Custom fabricated strainers can accommodate same-side or 90° offset piping orientation. There are also designs that minimize the distance the pipeline is above grade. The idea is to be able to vent and drain the basket chamber safely and easily. Removing the element should not cause unnecessary straining or place the operator in an unnatural/unsafe position.

One reason we are not offering "shopping cart" based e-commerce is that selecting the proper pipeline strainer involves consideration of many criteria besides the pipeline size, particle size to remove and material of construction. We have designed our inquiry forms to be specific to the type of strainer in question and to prompt for the necessary design criteria so that we can provide a proposal for a properly sized pipeline strainer. We can also help you compare different designs, perhaps between an exotic alloy custom fabricated simplex basket strainer and PTFE lined or entirely molded PVDF version.

The proper selection of pipeline strainers ensure ideal downstream quality and process conditions while minimizing labor, which in-turn enhances safety and reduces operating costs. This is accomplished by identification of critical design criteria such as strainer configuration, material of construction and particle size to remove with consideration of fluid velocity, differential pressure and space constraints.

Chris Pasquali has been trained by Hayward Flow Control and Eaton Filtration, having provided sales and engineering support since 2001.