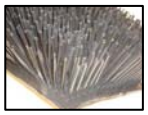
Choosing the Right Brush to Effectively Clean Your Pipeline

With the need for fossil fuels being at a record high, the importance of maintaining the condition of the pipeline systems which transport these types of fuels is critical. There are hundreds of thousands of pipeline miles in the United States alone that transport energy resources in the form of natural gas, crude oil and products, which are vital to our nation's economy. For this reason, among others, preserving the integrity of these pipelines is of the utmost importance.

For decades pipeline companies have used tools called "*pipeline pigs*" in an effort to clean debris from their pipeline systems and maintain the maximum level of product throughput and to prepare their lines for internal geometrical and corrosion inspections. Pipeline pigs are typically equipped with cups and discs or a combination of both. In addition, cleaning pigs can be fitted with other types of cleaning elements such as brushes and magnets for removing scale, hard deposits and ferrous metals. Pig design is dependent upon a number of factors such as line length, product being transported, types of fittings, wall thicknesses, and anticipated debris removal; therefore no one pig or no one type of cleaning element will be effective in every pipeline. Pig selection should be considered on a case by case basis, moreover, the types of cleaning elements added to any given pig are vital to ensuring effective cleaning results are achieved.

When considering what type of cleaning components to add to a pig, wire brushes are typically one of the most important elements that can be implemented. This is because of their ability to remove scale, rust, and other types of corrosive debris from the pipeline system which could build up, restrict flow and cause metal loss. Cleaning pigs which are equipped with brushes "will clean the inside of the pipe and with repeated runs will burnish the inside of the pipe wall and create a smoother surface, increasing the flow and efficiency." (*Cordell, Vanzant. All About Pigging: On Stream Systems, Ltd., 1995, Page 2-15*). However, like cleaning pigs, there are several types of wire brush styles that can be incorporated on a pig; there is no single brush that should be considered as a "fix all" solution.

With internal corrosion inspections being a crucial part of any pipelines agenda it is extremely important to ensure the pipeline subject to inspection is clean of debris and the inner pipe wall is free of scale and other forms of build up. Most, if not all, pipeline inspection companies will typically require a minimum of one cleaning pig equipped with brushes be run through the pipeline system to clear the pipe wall of debris, giving the corrosion tool the most favorable atmosphere possible to collect good data. With the aforementioned facts in mind, the question then becomes what type of brush or types of brushes does the cleaning pig need to be equipped with? Outlined below are a few types of prominent brush designs usually considered for cleaning applications:

- **Flat Wire Brush**:  

This brush is usually made of carbon steel, but also available in stainless steel and nylon material for special applications. Flat wire brushes typically come in a *wrap around* style or a *spring loaded block brush* style. The wire on this brush is flat by design and due to its size and shape does not recoil or penetrate corrosion pits well. Flat wire brushes are primarily used to remove dirt, scale and larger types of debris build up from the inner pipe wall. Flat wire brushes should be used to pave the way for other types of brushes that are designed to probe deeper into pits.

- **Round Wire Brush**:  

Made of carbon or stainless steel, the diameter and shape of this wire brush is ideal for penetrating and cleaning corrosion pits. The effectiveness of using round wire brushes can be contributed to the varied trim lengths, the bristles lengths are uneven, which allows the brush to clean corrosion pits more effectively. In addition, this style of wire has excellent rebound, rendering it more effective as it traverses wall thickness changes allowing the brush to spring into varying crevasses within the pipeline. Round wire brushes can be manufactured into a *wrap around* or *spring loaded block style* and because of their versatility, this type of brush will still allow most pigs to safely pass 1.5D bend radii and 25% restrictions.

- **Pencil Brush**:  

Constructed of fine, round wire, pencil brushes have an even trim length and are best used to remove rust and loose debris from inside the pipeline. Pencil brushes have good rebound which allows the brush to maintain a level of consistency as it progresses through varying internal diameter changes but the way the brush must be mounted to the cleaning mandrel decreases the versatility of the pig, making the pig itself more rigid in nature, diminishing its ability to negotiate extensive restrictions.

- **Wire Wheel Brush**:  

Typically made of carbon or stainless steel, this type of brush is primarily used in smaller pipeline diameters and is usually not as aggressive in nature due to its fine wire diameter and excessive flexibility.

- **Scrub Brush:** 

  This type of brush is commonly wrapped around the circumference of foam pigs. The bristles are made of fine wire which is extremely short, usually not more than 3/8 of an inch long. This type of brush is excellent as a finishing or polishing brush and will bring a shine to the inner pipe wall, ensuring a smooth surface.

Each of the previously mentioned brushes has a specific function in the realm of pipeline cleaning. In addition to each brush having its own set of unique characteristics many other factors should be considered to achieve the best cleaning results such as, bristle length, wire diameter, pig design, pipeline bend radii and potential restrictions the cleaning pig may have to pass through. For example, a 24-inch cleaning pig equipped with cups, scraper discs and flat wire wrap brushes may be designed to safely traverse 1.5D bend radii and 25% restrictions. This type of pig design would be able to pass through these pipeline features because of its basic configuration, length, placement and type of brushes on the pig body. However, take the same pig configuration but incorporate pencil brushes instead of wrap brushes and the dynamics of that pig will drastically change. This is because pencil brushes are mounted onto the pig differently than a wrap brush. In addition, to achieve the best cleaning outcome, the trim length of a pencil brush must be manufactured to a certain dimension in respect to the pipeline in which it's running; this dimension is typically shorter than that of a wrap brush. Therefore, because of the different brush style, method of mounting and bristle dimensions, pencil brushes tend to be less forgiving, resulting in the same 24-inch cleaning pig being able to only pass through 3D bend radii and restrictions far less than 25%.

In conclusion, it is highly recommended that all aspects of the pipeline in question be considered before choosing a cleaning pig equipped with brushes. No one pig or one specific type of brush is the answer to obtaining a clean pipeline, but using a combination of pigs equipped with various types of brushes will effectively clean the pipeline system, help maintain its integrity and will increase its efficiency.

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