Technical Publication

Flow Switches For Refinery Water Treatment

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Reliable monitoring and treatment of water in oil refineries is essential for the production of petroleum-based products, including gasoline, diesel, kerosene, heating oil, and byproducts for plastics and a variety of lubricants. There are three process areas within refineries that require large amounts of water: cooling units, desalter units and wastewater treatment.

Cooling Units

An important refinery process that uses water involves the removal of heat from machinery and heated process material. This equipment and material produces a tremendous amount of heat that must be reduced with heat exchangers and cooling towers. The cooling towers are evaporative units that are used for cooling the circulating water throughout the plant. All the cooling water running through these processes results in wastewater that must be treated to avoid environmental damage.

Desalter Units

Hydrocarbon liquids such as Benzene, Toluene and Xylene contain salts and aromatics. The salts in the hydrocarbon liquids are corrosive and foul process equipment, which means they must be removed early in the process. In order to remove the salts and aromatics, a hot water flush is applied to the hydrocarbon liquids in a refinery desalter unit. This creates large amounts of wastewater with volatile organic carbons (VOC's) that must be treated before it is either recycled or discharged.

Water Treatment

The water used in the the cooling units, desalter units, and other water from throughout the plant creates a large amount of wastewater with VOC's that must be treated before it is recycled or discharged. There are many different types and choices of systems, chemicals, filters, membranes, screens, etc., that can be used in refinery wastewater treatment. They all, however, have one thing in common: liquid flow switches are necessary to monitor and control the flow of water and chemical additives throughout the wastewater treatment system

Liquid Flow Monitoring

Flow switches are used at multiple points in water applications that range from pump protection to valve leak detection. In selecting a flow switch for refinery water applications, the first step is choosing the appropriate flow switch technology.

There are numerous flow switch sensing technologies available from multiple manufacturers. They all have their advantages and disadvantages, including the required reliability, process media (clean liquids, dirty liquids, slurries) and your application's requirements.

Thermal flow switches, for example, are a popular choice in refinery water applications because they offer exceptional reliability with no moving parts and a mean time between failure (MTBF) rating of 190 years. Beyond flow switch reliability, there are several other factors to consider:

- Accuracy and repeatability
- Plant and process environment
- Installation and maintenance

Accuracy and Repeatability

You'll need to know the accuracy, repeatability and flow range of the flow switch that you plan to use. For example a typical thermal flow switch, such as FCI's Flow/Level/Temperature FLT93 Switch operates over a liquid flow range from 0.01 to 3.0 FPS (0.003 to 0.9 MPS), with accuracy of +2.0 percent of the set-point

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velocity over a +50°F (+28°C) temperature range and repeatability of +0.5 percent of reading (Figure 1). FCI also has an optional high velocity liquid flow switch to 10.0 FPS (3 MPS).

Plant and Process Environment

By considering your plant's environmental factors, such as climate, process temperatures, humidity levels, process pressure, etc., you'll find that some flow monitoring technologies are better in extreme environments. Look for a flow switch with a metal enclosure that is NEMA/IP rated for rugged outdoor applications. Thermal flow switches, for example, are rated NEMA4X and EExd.

Installation and Maintenance

Some flow switches are easier to install. Ask if the flow switch can be inserted directly into the process pipe (larger diameter pipes above 1.5 inches) or if it requires an inline configuration (smaller diameter pipes 1 inch and below) that will require you to cut and splice your pipes in multiple places. The thermal flow switch is inserted (or with spool piece for smaller line sizes) into the line using a threaded or flanged process connection. Check the maintenance schedules too – they will differ depending on the flow technology.

Conclusion

When you're upgrading or expanding systems that require water in a refinery, petrochemical plant, or any industrial plant, think ahead about the type of flow switches that you'll need. Consider the switch's reliability, accuracy, installation and maintenance requirements, and service life when analyzing switch total lifecycle costs to determine the lowest cost of ownership. ■

Figure 1. FCI Thermal Flow Switch