Introduction

RCS “In-Design” team are in the development stage of new gas-assisted atomizing system for injection of chemical inhibitor and biocides into upstream gas systems. The concept allows the use of concentrated chemicals with lower storage and logistical costs.

Injection of chemical inhibitors and biocides into process systems requires care in order to properly distribute the chemical into liquid systems and the required atomization into gas systems. In general, the flow rate of chemical for injection is low, often in the region of a few gallons per day or several liters per day. Injection into liquid systems is relatively easy with standard quills. Injection into gas systems requires atomization to properly distribute the chemical and avoid contact of the concentrated inhibitor liquid directly on the pipe wall, as in the form, ironically, it is corrosive. Current Cosasco atomizing nozzles allow relatively low flow rates and provide proper atomization. However, in very concentrated forms, which are now being used, dilution is required to work with existing nozzles. Gas-atomizing nozzles have the potential to avoid this dilution, allowing chemical injection rates from a few litres or gallons per day all the way to zero.

Gas Atomizing systems have been considered in the past but generally not pursued due to the ultra-compact design that is required within the access fitting. It allows the user to control the flow rate from zero to the maximum allowed by the nozzle and atomize the inhibitor to ensure proper distribution spray regardless of flow rate and remove the need to dilute the chemical before injection.

Gas atomizing spray nozzles are commonly used for water, paint and other liquids in atmospheric air conditions. They require both the gas and the liquid to be delivered separately right to the tip of the injection nozzle, and require careful control of the flows to ensure proper atomization.

Implementing the same concept into a pressurized process piping system involves more complicated engineering. Since the chemical is normally injected down the center line of the pipe, the spray nozzle must be directed down the center line of the pipe. This requires the injection nozzle and the right angle head for mounting the nozzle to be less than 2 inches to work with the Cosasco Two-Inch System.

Air cannot be used for the gas injection into process systems, so the most convenient alternative is to use re-injected process gas under controlled pressure and flow conditions. A pressure differential above process pressure is required for the atomizing nozzle, and hence the extracted gas from the system must pass through a pneumatically powered gas pressure booster to provide the differential. The types of pumps available to provide the relatively low pressure differential (up to 200 psi) on relatively low gas flows but at relatively high pressures (2000 psi) are very limited.
The pressurized gas is pumped into a tank to provide some pressure fluctuation damping and an even flow. A pneumatically controlled flow control valve will regulate the pressure to approximate 20-100 psi differential above process pressure which feeds to the atomizing nozzle. For proper atomization a carefully controlled pressure differential is required to be maintained across the nozzle. The precise pressure differential for these high pressure systems is yet to be verified by test at elevated pressures. Existing work suggests that 20 to 100 psi will be required, but little or no testing has been done to verify this. We have located a test facility where it should be possible to run tests, at least up to about 800 psi.

A differential pressure controller will provide a pneumatic signal to the control valve to regulate the gas injection pressure to the desired PSI. A standard positive displacement injection pump is used to inject and control the chemical flow rate. This type of pump ensures that the correct flow of chemical is delivered to the atomizing nozzle from zero to the maximum of the nozzle.

Gas atomized nozzle systems require two input connections, one for the gas and one for the inhibitor. These two paths must be continued right through the access fitting assembly and into the atomizing nozzle head. The atomizing nozzle uses the energy of the gas to properly atomize and disperse the chemical inhibitor in to the pipeline.

System Configuration

There are two possible configurations of the system depending on the source of the higher gas pressure to drive the 20 to 100 psi differential across the gas injection nozzle. The first system takes gas from a location adjacent to the injection nozzle and provides the required differential pressure via the gas booster pump and associated equipment. The second method uses an upstream gas pressure source, if available, that is at least 100 psi higher pressure than the injection point.

The system consists of a pneumatic powered gas booster, air supply regulator, gas filter, plenum chamber, flow control valve, ΔP pressure controller, access fitting, and atomizing assembly. These components are hazardous area rated and mounted on a skid. The access fitting and atomizing are mounted on the pipe. A source of compressed air is required to run the gas booster and provide the pneumatic source for the controller. If there is a source of higher pressure process gas to provide the pressure differential needed for the atomizer then the gas booster is not required.

The two possible configurations will require evaluation to validate the effectiveness of the gas atomization for the proper distribution of chemical inhibitor. Both systems have a clear potential to save operators considerable costs on chemical inhibitors and greatly reduce chemical inhibitor storage space and transportation costs.

If you would like more information on the new Gas Assisted Chemical Injection System or have an application that requires this type of system, please contact RCS at sales@cosasco.com or +1-562-949-0123.