

Gas Pipeline Cleanliness — A Unique Approach To Contamination Removal

Current gas pipeline operations require an onerous procedure of blocking, venting, opening, filter removal and replacement, closing, recharging, and returning to service gas filter/

powder particles typically range in size from 0.2 to 0.4 microns.

The Mueller Environmental Designs Helical Coil Separator Model KLS is a multiple element separator intended for the high efficiency separation of solids and/or liquids from gas streams that exhibit spray, annular, and slug flow regimes.

The separator consists of a cylindrical shell, which may be either vertical or horizontal, in which is installed a section of multiple small diameter helical coil tubes. The helical coil tubes are compartmented within the shell so that all entrained liquids and/or solids entering with the gas are forced to pass in parallel flow through the helical coil tubes.

The helical coil element employs all of the physical processes associated with separation equipment — impingement, centrifugal action, gravity and settling.

The helical coil element is primarily a separation device much like vane or mesh pad types, but utilizes inertial forces in such a manner that greatly improves separation efficiencies over a wide flow range without any change in particle removal efficiencies.

Each separator tube assembly (Figure 1) is made up of a helical element, outer tube shell, and clean gas outlet tube. The helical coil element is comprised of multiple helically coiled rectangular spiral passages with an inside

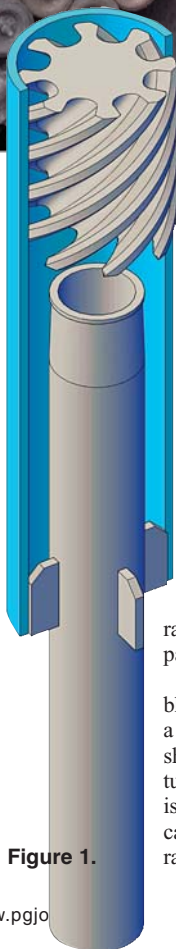


Figure 1.

separators. A need exists for more cost-effective and high efficient gas cleaning equipment that will operate during upset conditions. A new field-proven product has been developed that reduces costs, provides submicron particle removal efficiencies, and continues to function during upset conditions.

Typical gas pipeline contaminants include water, glycol, amine, methanol, compressor lubricating oils, salts, chlorides, liquid hydrocarbons, sand, dirt, production stimulants, and black powder. Of these contaminants, black powder is the most challenging.

Black powder contamination manifests itself through reduced pipeline efficiency, clogged instrumentation, valves that cannot operate due to an accumulation of debris, fouled compressor valves, and compromised filter/separators. The following photographs illustrate the magnitude of the problem.

Black powder presents in wet and dry forms and is found to contain a mixture of iron and sulfur-based substances along with iron oxides in a fluid fraction of aliphatic hydrocarbons, compressor lubrication oils, glycol and amine. Black powder particle size and distribution are fairly uniform based on samples taken from gas pipelines across the United States. Black



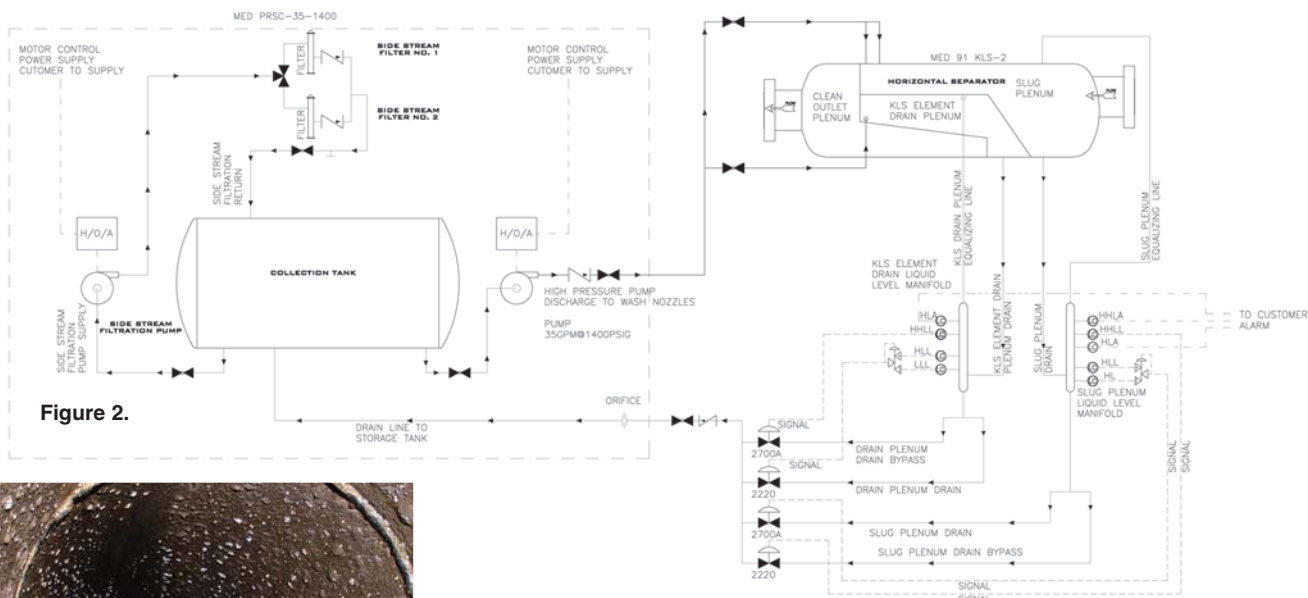


Figure 2.



radius surface.

When gas enters the helical passage, the angular velocity of gas stream creates inertial forces. The inertial forces have greater effect on particulate (liquid or solid) in the gas stream, thereby causing coalescence and encapsulation on the outside wall of the helical passage.

Chamfers on the leading and trailing edges of the helical passages collect particulate and remove them from the gas flow. Sheet flow and gravity carries the separated particulate into the sump for automatic or manual blow-down. Clean gas combines with gas from other compartmented separator tubes and exits the vessel.

The current most widely used gas cleaning technology is the filter separator. An alternative developed has a field-proven alternative providing the following cost-reducing benefits:

- Sub-micron particulate removal efficiency
- Reduced hazardous waste volume
- Operates during upset conditions
- Takes the filtering component out of the gas stream to a liquid stream
- No handling of pyrophoric materials by personnel
- No venting of gas to atmosphere

The above graphic depicts (Figure 2) a Mueller Submicron Viscous Impingement Gas Scrubber System flow diagram. The system design is also com-

patible in a vertical configuration.

The system (patent pending) is comprised of a KLS Helical Separator, high pressure injection pump, inlet liquid sparger system, waste collection tank (waste collection tank must be pre-loaded with injection liquid of customer's choice), duplex side stream filter system.

The high-pressure injection pump and inlet liquid sparger system will spray a liquid (hydrocarbon condensate, glycol, compressor oil, mineral oil, methanol, or other liquid as required) directly into gas stream at the inlet nozzle. Wet and/or dry particulate will become encapsulated within the injected liquid film and then removed from the gas stream by the helical separating element.

Removed solids and liquid will then be drained into the Helical Separator sump by gravity. Sump liquid level switches will activate a dump valve to purge both liquid and solids into a waste recovery tank. A side stream duplex filter system adjacent to the waste recovery tank will remove solids from the liquid for reuse in the high-pressure injection system.

The duplex side stream filtration system includes a re-circulating pump, three-way

valve and pressure differential indicators.

When the pressure differential reaches a predetermined pressure differential, an operator will operate the three way valve engaging the opposite filter housing. The filter housing that has depleted filter elements will be opened and filter elements removed and replaced and ready for service. Once the pressure differential reaches the predetermined pressure differential the process will be repeated.

The photo below shows a recently completed project. The system is comprised of a 91 KLS - 2 with liquid injection, waste recovery tank and duplex side stream filter.

This system will remove 99% of all solid sub-micron particles 0.3 microns and larger.

Black powder is one of the most challenging issues gas pipelines face today. It is a costly, labor-intensive, and environmental concern that spans across the United States. It is imperative that gas pipelines employ the latest technology in an effort to remain competitive and manage environmental issues. **PE&GJ**

