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Tech. Note No. 105

GAS BLENDING

Blending of different gases of similar densities is a relatively easy task for static mixers to perform. The important considerations which need to be evaluated include the following:

1. Extreme Volumetric Ratios
2. High Density Ratios
3. Injection Method
4. Flow Straighteners or Conditioners

VOLUMETRIC RATIOS

Volumetric Ratios less than 100:1 can be processed within a two (2) element ADMIXER, with or without upstream injection. For ratios greater than 100 to 1, but less than 1000:1, proper upstream introduction through a nozzle, injector, or sparger is required. For volumetric ratios exceeding 1000:1, a three (3) element ADMIXER is necessary, in addition to the injection system.

DENSITY RATIOS

Variations in density exceeding 5:1 are more difficult to process, and require a minimum of three (3) elements for sufficient homogeneity. Where both density and volumetric flow ratios exist, a four (4) element design is necessary.

INJECTION METHOD

Injection methods of secondary gas streams can be very critical to proper homogeneity. Without a proper method of gas injection, as many as four (4) Elements could be required under extreme flow/ density ratios. With proper injection, two (2) elements are sufficient under a wide range.

Several injection methods are available, from simple tees to multi-point spargers.

Examples are as follows:

Single Injection Devices
1. Pipe Tee or Y
2. Flush nozzle

Better Injectors
1. Centerline of pipe injector
2. Centerline injector facing upstream

Best Design
1. Multi-point injectors
2. Multi-port spargers

Velocity of the injected streams should be a minimum of two times the primary stream. Higher velocities may prove even more beneficial.

OTHER CONSIDERATIONS

All of the above conditions assume that turbulent flow exists (Reynold's number of 2000 or more). Gases traveling in a laminar flow regime are more difficult to mix, and require other design considerations.

The use of **Flow straightening devices** is recommended either before or beyond the ADMIXER under specific conditions. Flow straightening can be particularly useful immediately following a static mixer to reduce or eliminate eddy current or swirl formations that can develop upon exit of the mixer due to the high turbulence. Flow straighteners or conditioners before a mixer are used to eliminate velocity profile distortions caused by elbows, bends, gate valves, and other restrictions. The net effect is that a portion of the incoming stream can be traveling at a higher velocity than another segment. While a static mixer will very quickly eliminate or reduce velocity gradients, flow conditioners prior to the mixer can provide even greater homogeneity (99.9%) within a shorter length of mixer.