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Venturis and Flow Nozzles

Practical, Reliable, Accurate, Repeatable, Simple to Calibrate, Economical and Low Un-Recovered Pressure Drop

STORM

For many years we have recommended venturis and where the layout does not provide sufficient straight runs of ductwork, we recommend flow nozzles. By now, just about every engineer accepts the need to measure and control combustion airflow as a "must" when firing coal for low NO_X operation. Combustion airflows must be measured and controlled for the best NO_X, as well as operations and maintenance factors such as slagging, high-unburned carbon in ash, high superheater tube metal temperatures, waterwall wastage, flame stability, efficiency optimization and other O&M reasons.

Dispelling the Myth of High Non-Recoverable Pressure Drop

Venturis and flow nozzles do not have unreasonably high un-recovered pressure drop. The proponents of other primary elements usually emphasize the low pressure drop of their devices. We thought it would be well to remind our friends that the un-recovered pressure drop of a properly designed and built venturi is approximately 25% of the maximum design flow ΔP. In other words, a venturi with a full load ΔP of 4" w.c. will recover 75% of that ΔP, for a total loss of about 1" w.c.

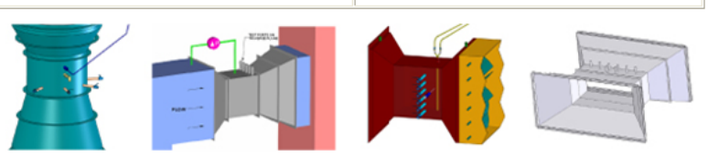
A case study of large venturis installed on the compartmentalized windbox of a 600MW B&W boiler follows:

The accuracy and repeatability of the venturis are in the range of 1% as measured by a manual pitot tube traverse. This means, the total stack up of tolerances from the traversing, reading of the manometer, calculations, transmitter error and human factors all combined resulted in ± 1% agreement. We usually use a goal of ±3% from the manual traverse measurements to the transmitted signals. However, with reasonably straight ducts, calibration accuracy in the range of better than ±2% is possible.

Often, in cases such as this the plenum pressure, F.D. discharge static, can actually be lowered due to the improved load response and accuracy of the measurement. We have seen this on primary air systems as well.

Benefits of Storm Venturis and Flow Nozzles:

- Storm venturis/flow nozzles are less prone to inaccuracies due to flyash plugging of the sensing lines. Storm venturis/flow nozzles utilize larger sensing line connections in which the skin taps are located and oriented to minimize plugging. This results in a differential pressure signal which does not drift over time.They do not have small holes like averaging pitot tubes which are inherently prone to plugging.
- Storm venturis utilize a skin tap upstream of the venturi (high pressure) and a skin tap within the venturi throat (low pressure). Therefore, there are no pressure measurement protrusions into the flow stream, so erosion and pluggage are not likely to occur.
- The major challenge in utility and industrial applications is a dust laden flow stream. Pitot tubes protrude into the flow stream, which in a clean environment is not an issue. However, in streams with even minimal dust loading, this results in erosion. Pitot tubes also have small pressure taps/holes located within the gas stream which often plug, causing the differential pressure indication to drift over time.
- Venturis improve mixing of the hot and cold airflows resulting in less stratified temperatures. This leads to more uniform temperatures at the pulverizer inlets when used for primary airflow.
- Storm venturis and flow nozzles are designed and built for periodic "Hot K" calibrations using hand pitot traverses, which are repeatable, proven and simple to do with plant instrumentation technicians.Also, venturis provide the best location for accurate test calibration in the throat.
- The total unrecovered pressure drop of venturis is normally a non issue in comparison to the magnitude of pressure drop due to duct configuration and dampers. When venturis are used in straight ducts, up to 80% of the signal pressure drop is recovered at the duct exiting the venturi.
- Storm venturis utilize a slightly higher differential pressure than averaging pitot tubes resulting in a much smoother and accurate flow indication across the flow range with more indication resolution. Pitot tubes with a much lower differential pressure are more likely to have an erratic flow indication (assuming a 0.8" w.c. max DP; at low airflows, as much as 0.1" w.c. differential change can result in as much as 30% flow indication change). Although the DP is slightly higher with a Storm venturi, they are designed such that minimal non-recoverable pressure drop occurs. Generally Storm venturis are designed for approximately 3-4" w.c. differential pressure at the maximum flow and less than 1" w.c. non-recoverable pressure drop. These are typical numbers. However, each Storm airflow measurement device is custom designed and manufactured. Therefore, the differential pressures and non-recoverable pressure drops will range. Storm provides approval drawings for each venturi including the designed differential pressure vs. airflow curves.



Storm Technologies, Inc. has a complete fabrication shop capable of designing and fabricating airflow devices to suit many different applications. Please give us a call to discuss your airflow measurement and management needs.

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