KURZ INSTRUMENTS INC.™

Complex Technology Made Simple

Application Brief

The Costs of Differential Pressure

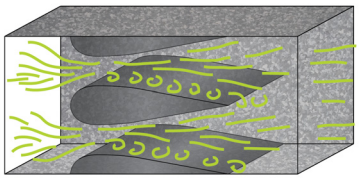
Differential Pressure and Choked Flow

Combustion Airflow monitoring applications (such as primary, secondary, and tertiary Air, overfire Air, stack gas, and flare gas) commonly use Airfoils or Venturis for measuring Airflow. However, any differential pressure obstruction in the flow stream prior to the combustion chamber causes a pressure drop that subsequently produces lower output from the engine. This pressure drop is a direct result of the choked flow. To adjust for this pressure drop, facilities frequently oversize or overwork the Air blowers, compressors, or fans to increase upstream flow or use heaters to preheat the upstream Air. However, these methods for increasing the flow and flow temperature also lead to increased costs for fuel, equipment, and maintenance. Additionally, some applications require additional valves or orifice plates downstream to obtain the necessary mass flow rate before the Air gets to the engine.

Determining an accurate flow rate requires knowing the air velocity and multiplying it by a cross-sectional area to calculate the volumetric flow rate. The Air flow blockage caused by an Airfoil or Venturi creates pressure drop, which results in a loss of total capacity and efficiency. To compensate for the pressure drop, motors, compressors, and fans have to work harder to ensure that additional Air is produced to keep the flow volume at the necessary flow rate. Simply replacing the obstructing section with a Kurz Instruments thermal sensor assembly can result in increased savings and more efficient performance.

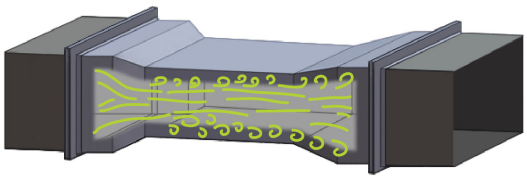
Airfoils

Airfoils, while difficult to install, are generally known to provide permanently high pressure loss. Particulate buildup on the Airfoils requires maintenance to avoid clogging.



Venturis

Venturi systems are specifically designed to create pressure drop using a narrow throat section. The Venturi must be part of the original pipe or duct design process to ensure the required upstream and downstream straight runs are maintained for accurate measurements. Because of their custom-made structure, Venturi systems typically have a high cost.



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$$Pi = \frac{\Delta P \, F_A}{E_M \, E_F}$$

where:

Pi	=	Input Power
ΔP	=	Pressure drop in Pascal
F_A	=	Actual Flow Rate in M^3/Sec.
E_M	=	Motor Efficiency
E_F	=	Fan Efficiency

Based on an existing system:

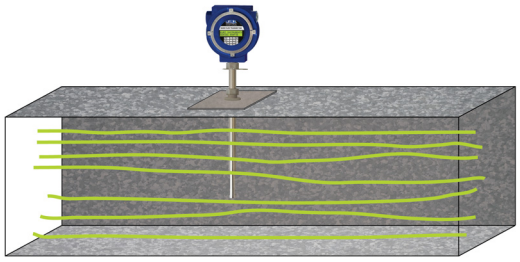
8,000 Hours of Operation
Area = 70 FT^2
Flow = 300K CFM
Motor Efficiency = 95%
Fan Mechanism Efficiency = 60%
Energy Cost = $0.12/kWh
ΔP = 4" WC

This system experiences a 65% blockage due to three Airfoils mounted in a 7' x 10' duct.

By changing out your current Airfoil or Venturi obstruction for a thermal mass insertion flow meter, the cost of energy savings allow quick recovery of your initial investment.

ΔP (inches H_2O)	ΔP (Pascal)	Amount of Air Available by Removing Obstruction		Projected Savings at $0.12/kWh Dollars ($)	Euros (€)	Pounds (£)
1	249	7200K CFH	(203940 M^3/hr)	59343	44626	37172
2	498	9000K CFH	(254940 M^3/hr)	118686	89252	74345
3	747	10800K CFH	(305940 M^3/hr)	178029	133878	111517
4	996	11700K CFH	(331440 M^3/hr)	237373	178504	148690
5	1245	12600K CFH	(356940 M^3/hr)	296716	223130	185863
6	1495	13500K CFH	(382440 M^3/hr)	356059	267756	223035
7	1744	14400K CFH	(407940 M^3/hr)	415402	312382	260208
8	1993	15300K CFH	(433440 M^3/hr)	474745	357008	297380

Keep It Simple



By eliminating differential pressure (DP) as a method for measuring the flow stream, it becomes much easier and more cost-effective to design and maintain your combustion control system — saving potentially hundreds of thousands of dollars per year.

Kurz thermal mass insertion flow meters allow you to redesign your in-line DP system and replace it with the pipe or duct configuration used throughout the rest of you combustion control system. Kurz insertion flow meters have almost zero effect on the flow stream, proven high accuracy, and are much more economical for both initial and maintenance costs.

Removing the obstruction and replacing it with a Kurz thermal sensor assembly will:

- Save money by reducing power consumption
- Improve efficiency by reducing fuel usage
- Improve efficiency by increasing air-to-fuel ratio
- Increase Air availability while reducing energy dissipation
- Reduce maintenance time and expenses
- Increase measurement accuracy, repeatability, and turndown, which improves combustion control
- Reduce CO_2 and NOx emissions due to lower fuel consumption