# Flow Rate Measurement In Emissions Monitoring

**The Kyoto Protocol requires a reduction in greenhouse gas emissions. The 485 Annubar® Primary Element in stackbar configuration can help monitor these emissions.**

Differential pressure (D.P.) type measurement for emissions flow monitoring is not only the economical choice, but also the technically correct choice. After all, relative accuracy is established by a D.P. method – a pitot traverse.

Emerson Process Management designed, built, and patented the first self-averaging pitot tube (Annubar primary element) in 1966. Only three years later, in 1969, an Annubar primary element was shipped to the Alberta province of Canada to measure flow in a 22 foot diameter stack. That was 37 years ago. The application is not new – the legal requirements are.

## Regulation

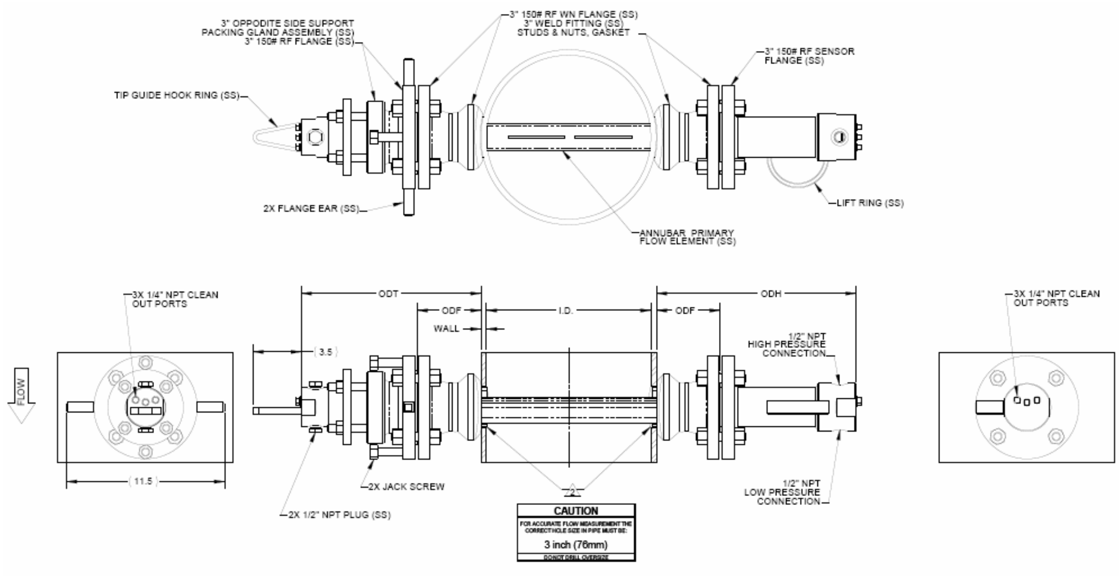
The Kyoto Protocol is an agreement made under the United Nations Framework Convention on Climate Change (UNFCCC). The agreement requires that industrialized countries will agree to reduce their collective emissions of greenhouse gases by 5.2% compared to levels recorded in the year 1990.

In order to fulfill the commitments made in the Kyoto Protocol, accurate measuring of greenhouse gas emissions is desirable. Accurate, reliable measurements of gas flows in stacks support the monitoring of emissions. Emerson Process Management can help provide a flow measurement solution for emissions monitoring applications.

## Annubar Primary Element Flow Sensors

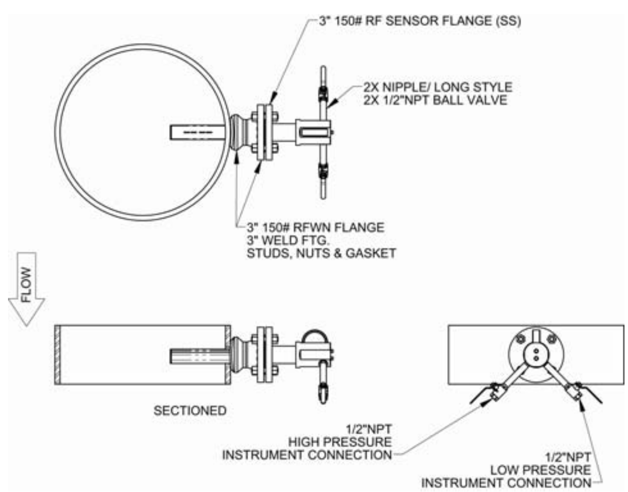
Emerson Process Managemement offers two solutions for measuring the flow of gases exiting a stack. The 485 with special code F5046 is a stackbar Annubar primary element that is supported at both ends.

*Figure 1: 485 with special code F5046 stackbar drawing showing all parts and dimensions contained in the sensor and mounting kit.*




The 485 with special code F5045 is a stackbar that reaches one-third of the way across the stack or one meter, whichever is shorter.

*Figure 2: 485 with special code F5045 stackbar drawing showing all parts and dimensions contained in the sensor and mounting kit.*



Both of these offerings are self-averaging pitot tubes. Emerson knows that the environment within a stack is dirty and could potentially clog sensing ports.

One unique feature that the Annubar primary elements can offer is large internal chambers which mitigate the restriction presented to purge gas flows.

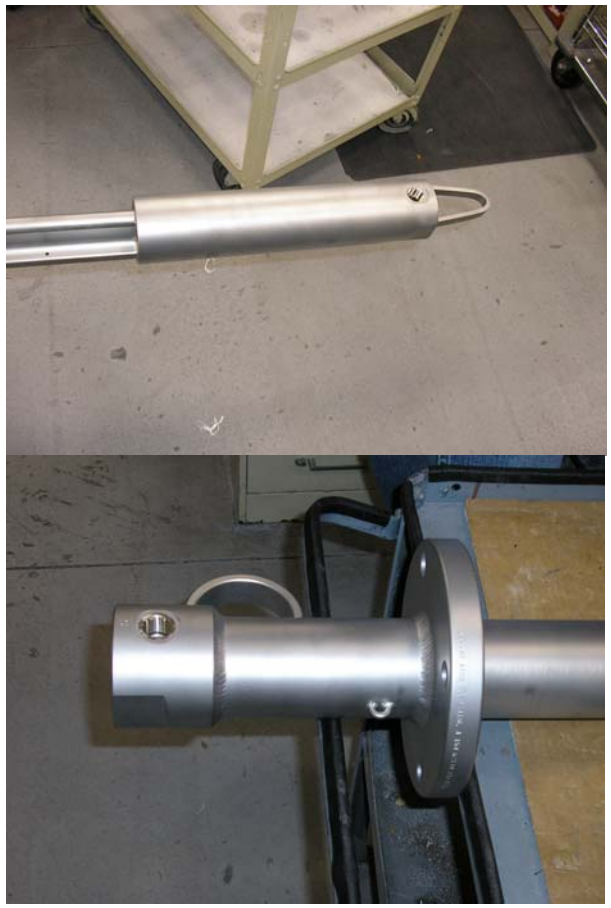


*Figure 3: Head and tip of stackbar showing large internal chambers.*

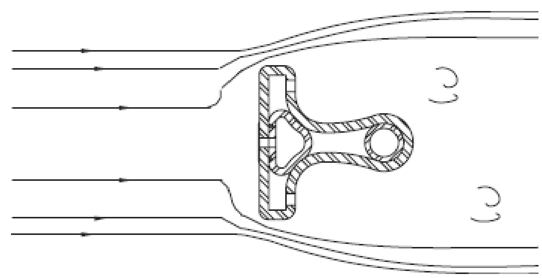
Another unique feature the stackbars offer is three ¼ inch NPT clean out ports which allow for the sensors to be "rodded" out. This means that a rod can be run entirely through the sensor to clean out the sensor's flow chambers.

*Figure 4: Head and tip of stackbar displaying three clean out ports.*

## Advantages of Purging

One inherent advantage of an Annubar primary element over devices such as orifice plates is the ability to function in flows carrying dirt and grease. The shape of the Annubar primary element causes most foreign material to flow around the probe rather than accumulate on it. The material that does impact on the probe does not significantly affect performance unless, under extreme cases, some of the sensing ports are completely obstructed or the outside shape is drastically changed by buildup. Emissions monitoring is one application that may require cleaning or purging of the probe.

*Figure 5: Particulate Deflection*



There are two methods of cleaning the Annubar primary element to restore performance. Mechanical cleaning is the more certain method, but does require removal of the Annubar primary element. Purging is effective if the accumulation covers the sensing ports or blocks internal passages.

In applications where a large amount of foreign material exists, it may be necessary to perform a routine preventative maintenance by removing the Annubar primary element for cleaning. The outer surfaces should be cleaned with a soft wire brush. The internal passages should be cleaned with compressed air. If necessary, a solvent for dissolving foreign material may be appropriate.

Purging with an external fluid source under a higher pressure is an effective means of retaining clear pressure pathways in the Annubar primary element.

The following precautions should be taken:

1. The purging fluid must be compatible with the process fluid and shouldn't cause other problems such as contamination.
2. The purging fluid should be preheated or pre-cooled if the temperature difference of the fluid and the process exceeds 150°F (66°C).
3. The differential pressure transmitter or meter should be isolated from the purge fluid to prevent over-ranging.
4. Continuous purging is not recommended.

The length of time between purges, or the cycle time, as well as the length and volume of the purge cycle must be determined experimentally. Some guidelines established as a starting point for experimentation are as follows:

1. Supply pressure of at least 60 PSIG (415 kPa-g) and not exceeding 115 PSIG (795 kPa).
2. Purge air flow rate of at least 40 SCFM (68 Nm3/h) when flowing at 60 PSIG (415 kPa).
3. Purge duration of at least 60 seconds.
4. Purge with dry air (less than 5% moisture by weight).

Stainless steel purge tubing should have a minimum of ½ in. (12.5 mm) O.D. and at least 0.035 in. (0.89 mm) wall thickness.

Care must be taken to protect the secondary instrumentation from high pressures and temperatures when purging an Annubar primary element. Ear protection is also recommended for all personnel in the vicinity of the system being purged.

**Photos of 485 Series Annubar Primary Elements Installed in Stacks**

*Figure 6: Stackbar installed in a stack*

*Figure 7: Stackbar installed in a stack with automatic purge system.*

**Emerson Process Management**
Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA
T (U.S.) 1-800-999-9307
T (International) (952) 906-8888
F (952) 949-7001

www.rosemount.com