LOW REFERENCE PRESSURE DISCIPLINE

By

L R Harris

Scanivalve Corp

1722 North Madson Street
Liberty Lake, WA 99019
Tel: (800) 935-5151
(509) 891-9970
Fax: (509) 891-9481
web site: www.scanivalve.com
e-mail: scanco@scanivalve.com

Scanivalve Corp.

Abstract

Low pressure measurements from inches H_2O to 15 psig are a large segment of the pressure measuring market. It is, unfortunately, very difficult to make accurate pressure measurements without taking barometric pressure into consideration. This paper discusses some problems and solutions in taking these differential/gauge measurements.

Introduction

Differential pressure measurements determine the pressure differential between 2 pressures. The sense, or positive, side of the sensor is connected to one pressure and the reference, or negative, side of the sensor is connected to the other pressure. Typically:

1) Both inputs are elevated above atmospheric pressure such as pressures across an orifice plate, or pressures referenced to a "line" pressure. Pressure sensors used for this measurement must have connections on both sides of the sensor. They are referred to as "differential" transducers.
2) One input is greater than, or less than ambient pressure, and the other input is open to ambient pressure. Pressure sensors used for this measurement may or may not have a connection on the low, or negative side of the sensor. These sensors are referred to as "gauge" transducers. A differential transducer may also be used for this measurement. Errors can occur in these measurements or during calibration if the reference (ambient) pressure is not stable.

This technical paper will deal with case 2 above.

Considerations

Differential pressure sensors have a simple linear equation. When the low side of the pressure sensor is open to the atmosphere, the equation is **DeltaP=P1-P2**

P1 is the unknown pressure to be measured.

P2 is the atmospheric (barometric) pressure.

Barometric pressure is not constant. It is a function of atmospheric conditions. Normal Barometric pressure will change in the course of a day. Normally these changes occur very slowly. However, Barometric pressure inside a facility can change quickly when an HVAC system cycles on or off, when a door opens or closes, or a fan turns on or off.

Barometric pressure has a negligible effect on high pressure differential measurements, but has a large effect on low pressure differential measurements. The examples below illustrate this effect on measurement accuracy for both low and high pressure measurements.

Example 1—Low Pressure measurement of 0.5 psid (13.842 inches H_2O/1.27 cm H_2O)

DeltaP=P1-P2 P1= 13.842 inches H_2O measurement P2 = zero (barometric pressure)

DeltaP= 13.842 inches H_2O – 0 = 13.842 inches H_2O

If the barometric pressure in the room were to change by 2 inch H_2O when the HVAC system cycles on, the differential measurement the user would see is:

DeltaP = 13.842inches H_2O – 2 inches H_2O = 11.842 inches H_2O which is a 14% error in the measurement.

When the HVAC system cycles off, the value of DeltaP would return to 13.842 inches H_2O.

Example 2 – High pressure measurement of 100 psid

DeltaP = P1 – P2   P1 equals 100 psi   P2 = zero (baseline baro)

DeltaP = 100 psi – 0 = 100 psid

If the barometric pressure in the room were to change by 2 inches H_2O when the HVAC system cycles on, the measurement the user would see is:

DeltaP = 100 psi – 2 inches H_2O (0.072 psid) = 99.928 psid which is an error of .07% in the measurement.

As you can see from these examples, the barometric line pressure changes for low pressure sensors are more critical than it is for higher pressures by a factor of 200 times. So for this paper, we will be working with low pressure measurements of 15 psid and less.

Solution

The solution for good accurate low pressure measurements is to take control of the reference side of the pressure sensor or pressure scanner. There are several things the user can do to control and minimize Barometric changes. The first thing is to place the pressure scanner or pressure transducer in a pneumatically benign location that is not near a fan, room doors, or air conditioning systems.

When this is not possible, the next choice would be to run a tube from the common reference port on the pressure sensor and route this tubing to a pneumatically benign location.

This is not always practical. A good solution would be to connect the reference input to a static basket, or static bottle, to minimize the potential for measurement errors.

Pressure Static Bottle

A simple method that can be assembled as shown in Scanivalve drawing 81263-1 (Figure 1) would be using a 3 inch ABS pipe with caps on both ends. Fill the tube with over the counter fiberglass batting, steel wool or equivalent non-corrosive expanded mesh. One end of the static bottle cap should have a .020 inch diameter hole as a vent. The opposite end cap should have a 1/8 inch pipe thread tapped hole to receive a compression fitting. This bottle should be mounted somewhere accessible to the reference side of the pressure sensor, or pressure scanner. The end result is a quiet barometric immune to small changes in the room ambient.

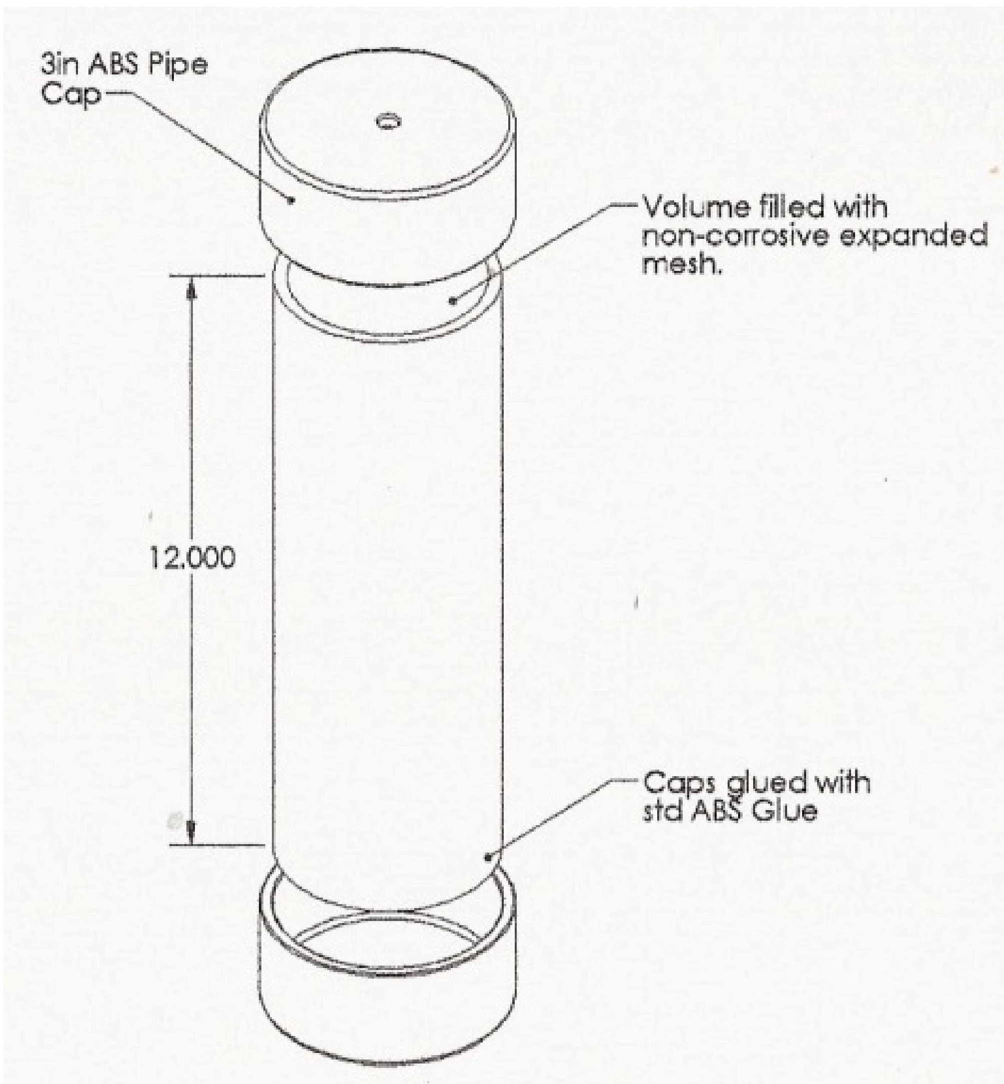

Figure 1 – Pressure Static Bottle

Pressure Static Basket

For larger facilities where many pressure measurements are made and multiple static lines may be used, a static basket may be the preferred choice. Scanivalve Corp offers a pressure static basket, Scanivalve part number 80893 (Figure 2). A drawing may be found on our website at http://www.scanivalve.com/pdf/prod_80893-1staticbasket.pdf

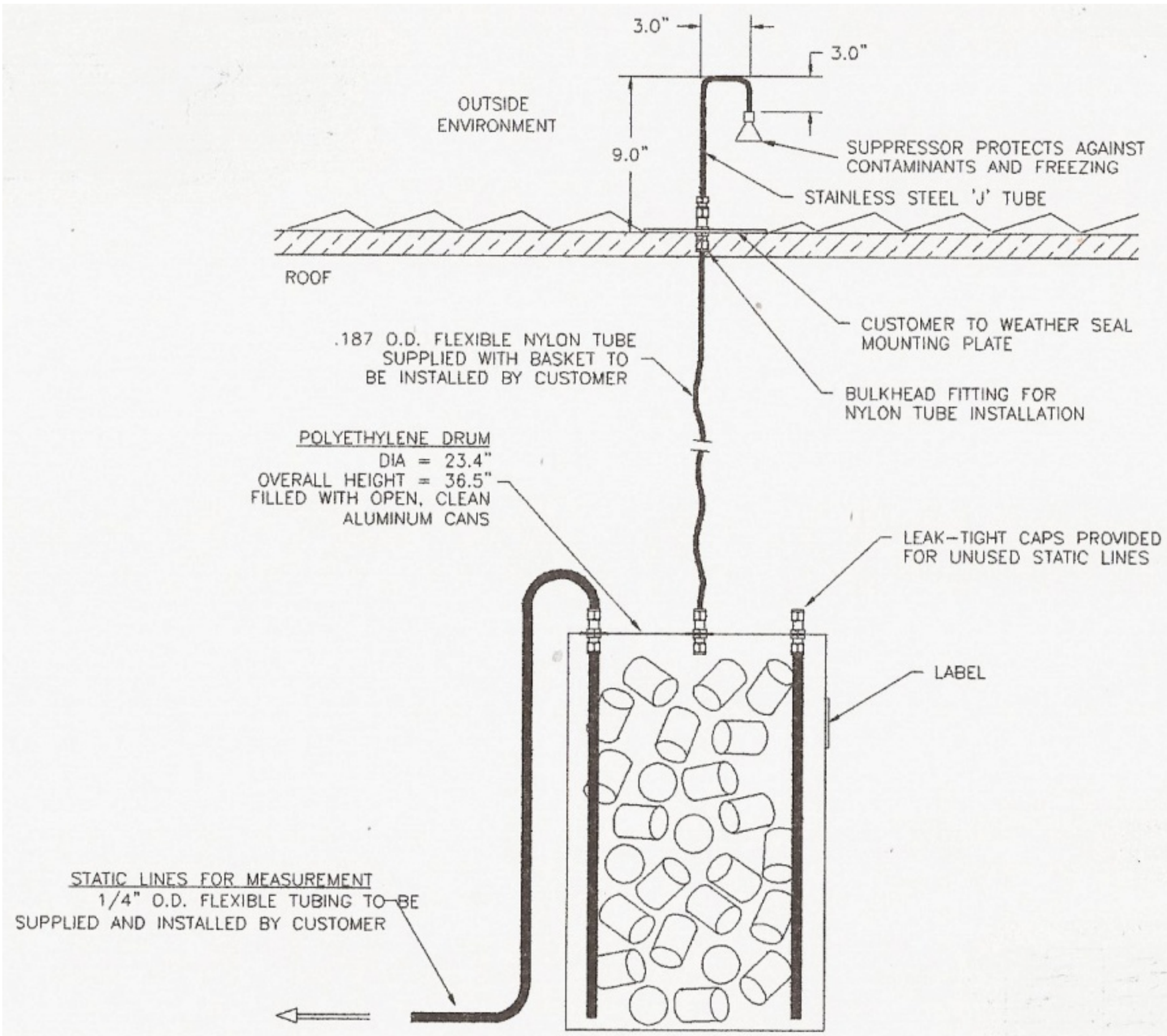

Figure 2 – Pressure Static Basket

Conclusions

Good static discipline is essential for accurate low pressure measurements. This is also true during calibration of differential pressure scanners. The static bottle, or static basket, provides a stable ambient reference pressure that is immune to pressure changes due to HVAC systems, people movement, and doors opening and closing.

It is important to consider static reference discipline on all pressure measurements, but it is critical for pressures 15 psi and below.