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APPLICATION OF ELECTRO-MAGNETIC FLOW METER ON PRE-DETERMINING BAG FILLING MACHINES.

Background:

During the past number of years, we have seen the move by the dairy, food and beverage industry, toward using poly bags and poly bags in boxes as a packaging medium. This move has necessitated the development of machinery to accurately fill these bags. Certain machines use a positive displacement cylinder that contains a predetermined volume, while other machines use a predetermining counter device, which is interfaced with a flow measurement device. I would like to address in this paper, the latter machine specifically relating to the flow measurement device.

There are a number of flow measurement devices on the market today ranging from positive displacement meters to electro-magnetic flow meters. Positive displacement meters are very accurate meters but tend to be rather expensive and usually require a great deal of maintenance. Today, many strides have been made in improving positive displacement meters by incorporating pistons that can be CIP'd and the use of electronic pulse transmitters in order to interface them with electronic counters. They still have many applications for this type of device especially where very accurate measurement is required with products that are non-conductive of electricity such as oils and certain types of syrups.

Because of the expense of the positive displacement meters, many companies in the filler industry decide to use what is known as a turbine meter. This meter works on the principal of a turbine rotor, which spins as product is passed through it. As the blades of the rotor spin, they pass a transducer, which senses that the blade has passed it and in turn creates a pulse, which is then sent to a counting device. These pulses in turn are converted into volumetric units such as litres, and gallons. Initially, these turbine devices seemed to work pretty well but with the advent of acid sanitizers and high speed cleaning systems many problems started to develop with the turbine meters. In addition, the acid sanitizers start to corrode the rotor blades thus changing the number of pulses sent for a given volume of product. Because of its nature, the turbine meter also requires that for each different product a different factor (K-factor) be entered into the pre-determining counter. When one combines all these problems, it is very difficult to accurately fill a bag with a known volume of product on a consistent basis. Turbine meters also require a great deal of maintenance with rebuild kits ranging from $550 to $1500.

Electro-Magnetic Flow Meters:

The electro-magnetic flow meter is based on the principle of Faraday's law of Induction. To simplify the explanation, if one induces a magnetic field for example across a pipe and a conductor is moved at right angles through the field, then a voltage proportional to the velocity of the conductor will be induced. There are many other factors involved in this law, which I feel would only serve to confuse the reader.

Electro-magnetic flow meters have been in existence for many years and their evolution has been moving fairly slowly until recently. Many companies manufacture these meters, but few have been successful in developing a meter that is accurate within very tight tolerances.

PROCES-DATA a company solely devoted to process electronics has developed the very first completely microprocessor based Electro-magnetic flow meter with extremely tight calibration specifications regardless of product density. The specifications are + or – 0.30% in a 10 to 100% flow range but in reality, tolerances of + or – 0.10 or better are realized. With this in mind, I approached TWINPAK INC., a company that fabricates filling machines with the idea of performing a series of tests using the PROCES-DATA PD340 mag meter. I spoke with Mr. Peter Weber who is the Director of Corporate Technology Development and he was most interested in performing a series of tests using the PD340. Terry Rochfort, the Director of Technical Services was assigned to co-ordinate the project.

Test Equipment and Procedures:

We decided to perform the testing in the Brantford facility of TWINPAK and Mr. G. Himmel was assigned to oversee the project along with Mr. J. Barrette, from the Montréal office. A date of May 26, 1988 was set for the tests to be performed. The filling machine used was a Twinpak single head filler model no. 1000C1TW. This machine is equipped with a Durant Series 100 single stage-predetermining counter. A Proces-Data PD340 C38 11/2 inch meter was used. The medium was water from a city supply pumped into a tank. A pump with a variable speed drive was used to pump the water from the tank to the filling machine. The variable speed drive was necessary in order that we could test the equipment at various pressures and flow rates. We encountered some initial problems with the frequency of pulses coming from the meter and going to the Durant controller but after re-programming the meter, we were able to proceed with our testing.

Test Results:

Test #	Flow Rate (LPH)	Counter Volume (L)	Scale Weight (Kg)	Deviation (%)
1.	10200	5.90	5.89	0.17
2.	10200	5.90	5.89	0.17
3.	10200	5.90	5.89	0.17
4.	10200	5.90	5.90	0.00
5.	10200	5.90	5.89	0.17
6.	10200	5.90	5.90	0.00
7.	10200	9.90	9.91	0.10
8.	10200	8.91	8.91	0.00
9.	05762	8.60	8.61	0.11
10.	05762	8.60	8.61	0.11

Test Result Comments:

Through using the variable drive, we achieved different flow rates and pressures thus causing different mechanical reactions in the filling machine. If you will notice the counter volume, you will see that the volume indicates 5.90 Litres. The preset was actually set for 5 Litres and at a flow rate of 10200 LPH; we experienced a .9 Litre overrun because of the reaction time of the solenoids and valve. At the slower flow rate, we experienced a .6 Litre overrun consistently. These dynamics are normal for any mechanical device such as this machine. The important factor in this is the repeatability of the reaction and as is evidenced by the volume counter reading and the scale weight.

In regard to the deviation difference between the scale and the meter, it must be taken into account that there is an error in both measuring devices, therefore for example the average deviation on all tests would be approximately 0.05% if one allows for tolerances in both devices.

Twinpak also conducted tests at a later date where the turbine meter was put back in line and the same tests were conducted. During this battery of tests using water, variations higher than + or – 0.50% were noted as compared with + or – 0.05% on average using the PD340 (test results Twinpak Nov. 21, 1988 PDR1076-PD340). This represents ten times the accuracy between the PD340 and the turbine meter.

The PD340 has since been installed in plants on filling machines both single and double head fillers where a wide variety of products are being filled. Reports from these plants indicate that they are achieving excellent accuracy and repeatability when compared to the scale weights regardless of product viscosity.

Summary:

It is evident that the PD340 is a superior measuring device over the turbine meter both in terms of accuracy, the fact that it requires no maintenance as well as the fact that because of its design, it is not affected by the density of the product. What this means for the end user is decreased maintenance costs, superior inventory control and substantial savings by eliminating overfilling of bags in order to comply with Industry Canada Weights and Measures as well as excise requirements in the case of the alcohol beverage industry.

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