

## PETROL INSTRUMENTS S.r.l. - ITALY

### P D F L O W M E T E R S

#### SPECIFIC PROBLEMS ENCOUNTERED AND TECHNOLOGY ACQUIRED

##### 1. APPLICATION LIMITS

###### 1.1. max. pressure:

- 100 kg/cm<sup>2</sup> operating, 10" ANSI 600 PD flowmeter, Baiji - power plant Iraq , G.I.E. SpA - Milano purchasing order.
- ENEL power plants in Italy, such as Torrevaldaliga Nord (RM), Sermide (MN), Tavazzano (MI), Porto Tolle (RO), Termini Imerese (PA), Melilli (SR), Fiume Santo (SS).

###### 1.2. max. temperature:

- 220°C operating, 3" ANSI 300 PD flowmeters, Baiji power plant - Iraq , Franco Tosi Ind. SpA - Legnano (MI) purchasing order, total supply of 48 PD flowmeters and accessories.
- 170 °C operating, DN 80 PN 25 PD flowmeters, Alusuisse Group for Distillerie Italiane SpA plant of S. Giovanni Valdarno (AR). All stainless steel PD flowmeters, jacketed type with stainless steel jacket, for the measurement of phtalic anhydride and of maleic anhydride.
- 150 °C operating, DN 25 PN 25 PD flowmeters, Alusuisse Group for Ftalital SpA plant of Scanzorosciate (BG). Jacketed type PD flowmeters for the measurement of naphtalene. Under recommandation of Alusuisse Group we have just entered an order for the same type of PD flowmeter from the Jugoslav firm Boris Kidric.

###### 1.3. min. temperature:

1" size all stainless steel PD flowmeters for the measurement of liquid carbon dioxide (CO<sub>2</sub>) at -35 °C.

For this type of application it is necessary to closely evaluate the humidity degree of flowing liquid and the type of service, if continuous or intermittent, because of ice crystals may eventually grow-up inside the metering mechanism.

1.4. max. viscosity:

- 90.000 CP, DN 100 JIS 30 Kg/cm<sup>2</sup> FF PD flowmeters for the measurement of tar (from carbon), Nuova Italsider SpA - Genova purchasing order for Taranto plant.  
Repeating type order for altofurnaches supply lines.
- > 5.000 CP, many different applications to be eventually examined in detail.
- 5.000 CP, measurement of polyester at Distillerie Italiane SpA plant of S. Giovanni Valdarno (AR).

Very interesting application on truck loading lines. Not finalized because of customer was not able to separate the bubbles contained in the flowing liquid and evidenced by comparing the volumes totalized and the weight of product loaded.

It is anyway interesting to see the appearance of the polyester in polymerized condition. Just for your information it can be removed only by firing.

"Plexiglas" is very similar to involved compound because of it can be considered as its monomer version.

We are pleased to recall "plexiglas" because of, for its measurement, we have used "teflon" bearings to avoid that eventual traces of carbon from carbon bearings could pollute the product compromising its transparency.

## 2. CONSTRUCTION MATERIALS

2.1. AISI 304 stainless steel:

- 6" ANSI 150 PD flowmeters for viscous liquids, Anic SpA - Ravenna, Ravemul plant.

2.2. AISI 316 stainless steel:

- 8" ANSI 150 PD flowmeters for demineralized water, Enel Fiume Santo (SS) power plant.

2.3. AISI 316 stainless steel measuring unit:

- 10" ANSI 150 PD flowmeters for fuel oil, Ras Katenib - power plant Yemen, Esacontrol SpA - Genova purchasing order.

As far as we know there is no other producer in the world other than us for stainless steel PD flowmeters sizes 6" through 10" as above mentioned.

2.4. AISI 316L stainless steel :

- 3" and 4" ANSI 150 PD flowmeters for liquid fertilizers, at ex-Anic SpA now Enichem SpA plants of Ravenna, Manfredonia (FG) and Nera Montoro (Terni Industrie Chimiche SpA)

As far as Anic-Ravenna plant is concerned we are pleased to say that our PD flowmeters installed there, i.e., over 60 instruments, have been taken under close service control for about two (2) years with excellent results.

2.5. "moplen":

- such a PD flowmeter has been produced under the "pressure" and with the cooperation of Farmitalia C.E. SpA of Rodano (MI) plant, for the measurement of diluted hydrochloric acid (30-40%) and of diluted sulphuric acid (30-40%).

As far as we know do not exist on the world market other PD flowmeters with local totalization for this measurement and may be interesting to spend few words on how and why it has been produced.

Farmitalia C.E.SpA of Rodano (MI) had installed, since few years, a Siemens PD flowmeter nutating disk type, with all wetted parts coated with a thick layer of carbon, on diluted HCl line for reactor's supply.

Farmitalia C.E. SpA, which incidentally is an our good customer, knew that we had engineered for this particular service a PD flowmeter completely in plastic material but we didn't yet produce it due to the absence of an actual interest, i.e., a customer who had the opportunity or the willing to test it.

We do not know if for our luck or for Farmitalia C.E. misfortune a certain day the Siemens PD flowmeter, in spite of its quality of German product, became to mis-operate and broke-down.

The delivery time for the spare parts was about 5 months and therefore Farmitalia C.E. SpA people called on us saying that they were available to test, without any mutual engagement, an our plastic PD flowmeter till the arrival of Siemens spare parts.

We evaluated in about two (2) months the time required to realize the instrument prototype and accepted the Farmitalia C.E. SpA proposal considering that three (3) months about of actual service could, at least, provide enough reliable informations about instrument validity. Several days later a sudden call from Farmitalia C.E. SpA brought us to a crisis.

It was in fact happened that Farmitalia C.E. SpA people had used the plant for a pair of reactions even without the PD flowmeter on the diluted HCl line. Unfortunately they had mistaken the HCl volumes fed to reactor with the result that all the product, in the order of several quintals, was out of specifications. Consequently Farmitalia C.E. SpA was forced to waste all the product with the obvious consequences both economical and practical that, specially the people who have an experience of plants, may easily imagine.

The reason of Farmitalia C.E. SpA call was therefore to communicate that they were yet available to test our new plastic type PD flowmeter but that they wanted the prototype at their plant not later than 10 solar days.

We have to say that we have been able to do what required by Farmitalia C.E. SpA and that, except for some minor modifications which will be too long to analyze here, our PD flowmeter with all wetted parts in "moplen", except rotor's shafts and measuring unit screws which are in Hastelloy B, is now a reality, i.e., an instrument with over 15 months of satisfactorily operating service.

It is our intention to begin the national marketing of this PD flowmeter within the year 1987 but already now we have entered orders from the same Farmitalia C.E. SpA, from Recordati SpA and from Fina Italiana SpA.

As last we have to spend only two words about the selling price. The Siemens PD flowmeter 1" size that we have satisfactorily replaced was purchased by Farmitalia C.E. SpA, some years ago, at a price of about 10.000.000= It. Lire.

## 2.6. Miscellaneous experiences

- formic acid,  
dissolves the magnet of movement transmission system even if the magnet is a sintered of Fe<sub>2</sub>O<sub>3</sub> (82% by weight) and of BaO (18% by weight).  
In this case is necessary to use magnetic transmission with an Aisi 316 casing.  
acetic acid and its derivatives,  
the chromium plating normally provided to harden the surfaces of rotating shafts and the like. It is necessary to avoid this kind of parts processing.
- acetone,  
in peculiar conditions of pureness and of temperature may dissolve the resin type compound used to keep compact the carbon bearings.  
It is necessary to use a metallic type compound or pure carbon.

- water, hot (80-100°C),  
in such conditions water as other liquids like AMV/VEOVA (Anic SpA - Ravenna) destroy the nitriding eventually provided to harden gears or other rotating parts.  
For "destroy" we mean that it is dissolved the carbon accumulated on the surface by nitriding process.  
It is necessary in such cases to avoid this kind of parts processing.
- water, steril for syrup production,  
it is necessary that no part of equipment remains in the raw state as supplied by foundry.  
As a matter of facts these parts result as a good "habitat" for bacterium families which pollute the product.  
It is necessary to produce the PD flowmeters starting from semi-finished raw materials such as plates, bars, etc.
- water for human/medical purposes,  
in this case must not exist inside the instrument places where the liquid remains stagnant. Even the gears are not accepted from this stand-point.  
We are still studying the best mechanical solution for this type of application.
- plexiglas,  
see what said before about "teflon" bearings to guarantee the transparency of the finished product.

We have mentioned just above several types of water that we have metered or we are metering. Those mentioned however are only the experiences more interesting we have made. The complete typology of "water", that we have metered or we are metering, is in facts better evidenced by our reference list for metered liquids prepared either for water either for the other liquids.

Already now, in relation to the experiences made in metering so different liquids, our commercial department, in preparing the estimates, compares the liquid to be metered with the references for the same type of liquid, to ascertain the behaviour of the instrument on that particular liquid and eventually to suggest, in the estimate itself or directly to the customer, all the necessary recommendations.

### 3. PARTICULAR APPLICATIONS

#### 3.1. Water-carbon mixture (swedish patent):

- our PD flowmeters gave satisfactory results for temperatures above 95°C, on the tests made at A.E.M.- Brescia power plant.

#### 3.2. Gasoil-carbon mixture ("reocarb" type):

- we have supplied or have under test our PD flowmeters c/o underdetailed firms:
  - Nuova Italsider SpA, Taranto;
  - Ansaldo div. Impianti SpA, Genova;
  - Snam Progetti SpA - Milano, for Enichem Agricoltura SpA plant of Manfredonia (FG).

#### 3.3. Crude oil extraction platforms:

this type of application, continuously increasing since some years, has an its own story strictly connected to the experience acquired during the time by users and by producers involved in this industrial sector.

About 10-12 years ago were specified and ordered for this service PD flowmeters with inner parts in cast iron, see the platform F-10 in Red Sea.

However it came out with the time that the water and the sulphur compounds, which are sometime present in consistent percentages in the crude-oil, reduced the reliability of PD flowmeters by increasing the frequency of their failures, of their out-of-service time and so on.

Consequently specifications and orders were switched to PD flowmeters with inner parts in stainless steel and with materials in accordance to the "NACE" standard, properly issued by Americans for equipment in service on liquids containing percentages of sulphur compounds.

But another PD flowmeters configuration, just in this period, is superposing to the latter configuration above mentioned.

This newly incoming configuration foresees all Aisi 316 stainless steel PD flowmeters and, stating all Aisi 316 stainless steel we mean that shall be in stainless steel not only the PD flowmeter outer housing, flanged to the piping, but even the support of the register, the gears which are moving the register and the register itself including its fixing screws.

The main reason for such a newly incoming configuration of PD flowmeters for platforms arises from the fact that the salinity destroys very soon all the parts not in Aisi 316 if not painted and re-painted continuously.

A simple economic evaluation shows that the higher initial cost of equipment is immediately and largely justified by the reduction of maintenance costs related to the continuous painting of the instruments.

Such a newly incoming PD flowmeters configuration has been initially discussed with Agip SpA - Gela (CL), to which we have just delivered a PD flowmeter so manufactured and presently under purchasing stage.

The other tendency which is strongly coming-out is that PD flowmeters for platforms are of double case type, i.e., with measuring unit (inner housing plus rotors, shafts and gears) removable from the outer housing flanged to the piping.

The reason of such tendency is as simple as evident.

Normally on the platforms, sometime placed at many kilometres from the coast, there is not much room available for a spares warehouse and it is not always true that between the platform personnel is available a specific "fitter".

It is therefore evident that should have been installed double case type PD flowmeters, in the event of a their failure, any platform people is able to remove the PD flowmeter outer rear cover and to replace the "out-of- service" measuring unit with a new one measuring unit, already assembled and ready for replacement.

In such a way the stand-by of the line is reduced to a minimum and the room required for the storage of measuring units already assembled and ready for replacement is reduced to minimum too.

Therefore the "out-of-service" measuring unit may be shipped to the platform service works on the coast or even to the producer for the necessary maintenance without influencing the platform operation.

On the other hand, should have been installed single case type PD flowmeters it is evident that is necessary to remove the entire PD flowmeter from the line, which must therefore be stopped, and then choose between the underdetailed alternatives, which are of course not to much attractive:

- try to repair the PD flowmeter on the platform; but, in this case skilled personnel and a good spare warehouse should be available on the platform itself;
- ship the PD flowmeter to the platform service works on coast and try to repair it there.

In the meantime, however, or the line remain idle or it is operated without the PD flowmeter, i.e., without the possibility of totalizing the volumes flown.

We do believe that double case construction type is one of the main reasons which are permitting to us to replace many PD flowmeters produced by others, specially Itt/Conoflow (see Agip SpA - Chieti).

3.4. Volumetric compressor type "volumex":

the last item in the field of "particular applications" is something that has nothing to do with the volumetric measurement of liquids but it is very close, we should say at 1 mm or at 1/10 of mm, to the PD flowmeters of our production.

We believe that many technicians and surely all those who are interested to car engines, have heard something about the "volumex", the compressor installed on many of the cars produced by Lancia, to generate an over- pressure on the air entering the engine ,i.e., an over- supply of the supporter of combustion.

Well, the "volumex" is exactly realized as an our 3" size measuring unit. More exactly speaking the rotors have the same dimensions in terms of 1 mm. if not in terms of 1/10 mm.

Due to the manufacturing identity we have been required by an agent of "Opel" to produce something like the "volumex" but suitable for the installation, in the easiest possible way, on the Opel Kadett 1.6 D, the reduced engine sprint of which was generating consistent troubles in the sale of this type of car.

We did that and have realized a compressor to be installed in the air-filter carter without any modification of the existing melted components.

The results have been excellent, having obtained an over-pressure of about 1 Bar, and, in such conditions, we could experiment that the pick-up, from standing, of the Opel Kadett 1.6 D was better than the pick-up of an Alfa Romeo 33 gasoline.

Unfortunately the industrial approach of such a product looks to be very difficult due to the authorizations required by the involved Ministry.

We have been anyway pleased to mention the story of "volumex", to demonstrate the reliability of our PD flowmeters operating principle.

In facts, the rotors of our PD flowmeters, at max. rated flow rate, turn at values ranging from 300 rpm through 800 rpm, while both the rotors of the compressor we have built-up and the rotors of "volumex" turn at around 8.000 rpm, i.e., a speed about 10 times higher.

Furthermore the use of the "volumex" on cars, produced in series and therefore subject to a continuous utilization and to which, for obvious reason, is required the maximum reliability by the producer, keep us completely sure about the utilization of the same operating principle for the measurement of industrial liquids flow rate.

We also retain that what above should keep our customers completely sure when specifying a rotor type PD flowmeter for applications where, as in the above mentioned case of Farnitalia C.E. SpA, the PD flowmeter is an essential component of the plant and to which, therefore, the highest reliability is required.

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