

Last but not least development of the Prayon tilting pan filters

1. Preamble

Every body knows the Prayon tilting pan filters used in the phosphoric acid field, but it is difficult to trace each development step which was brought by the Prayon-Profile team. So it is today possible to reach a useful filtration surface of 300 SQM (3.230 SQF) for a single classical filter made with proven components already existing on filters of smaller surface and 130 SQM (1400 SQF) for the new TDI filter. Further to these comments, the purpose of this paper will be to show the recent developments of some sub assemblies.

2. State of the art (picture n°1)

Today the biggest vacuum filter in the world (247 SQM or 2660 SQF in wet discharge) has been designed, manufactured, shipped in Morocco and is ready to be erected in a new phosphoric acid plant (1200 T P205/day per the Prayon dihydrate process). Normally it should be in operation end of 2007 or in the beginning of 2008.

At the early stage of the project, the surface required was equal to the surface of our 30.165EE Prayon filter (231 SQM or 2486 SQF in wet discharge) in successful operation at the IMACID plant since 1998. For this new project called OCP BUNGE, the technical management of OCP expressed their wishes to get some more surface but they were not in favor to change anything in the general layout of the filtration unit. So after a careful study it came out that, staying in the same foot print, it was still possible to win $\pm 7\%$ of the filtration surface. Thanks to small modifications of the following parts.

The filtration pans (picture n°2)

The surface increase has been possible thanks to some folds made judiciously on the small basis of the trapeze. This new design (patent pending since 29 march 2007), allows in fact to extend the pan in the filter center direction.

The splash guard

A polygonal shape (outside and inside) instead of a round one allowed to imagine a special contact seal for crossing pan trunions. Thanks to this design it was possible to reduce the gap between pans and splash guards and to increase the length of the pans.

A pretilt (sketch n°1)

It was demonstrated that the pretilt of the pans located before the main tilt was also profitable to increase the pans surface.

The inverting track (picture n°3)

It was possible to reduce the dead angle of the pans inverting and up righting due to different low acceleration/deceleration values taken in account for the design of the inverting tracks and due to different inclined positions of the pans at the key points. To be also noted that this filter is also equipped with the stop roller system allowing to decrease the load on one the tilt arm roller and to increase the speed of the filter up to 2 min per rev.

3. Developments planned to reach 300 useful SQM (3230 SQF – in one single unit.

On the valve: (sketch n°2 and picture n°4)

The changes necessary to allow bigger gas and filtrate flows will be reduced to

- A new manifold with 36 inlet pipes
- A deeper stationary part in order to increase the vertical section for the gaz-liquids per separation

On the pans (sketch n°3)

Having already in operation pans of more than 9 SQM on existing Prayon filters equipped with 30 pans; 36 pans of \pm same surface can easily be fitted to achieve 300 SQM (3.230 SQF)

On the car frame

As the filter will count 36 pans of \pm 9 SQM it will be necessary to increase the radiuses of inner and outer car frame rings. To this end, the number of sections could be increased but the resistance section drastically improved by the double web concept can stay practically unchanged if the number of support casters is increased proportionally to the radiuses. As the distance between the two car frame rings will be slightly increased, the cross members should be reinforced by choosing bigger pipes or beams.

On the support casters

The same support casters will be used but the number has to be increased roughly speaking proportionally to the radiuses of the car frame rings but also in accordance, with the extra weight of the pans; the car frame and the splash guards. Today we are using casters able to support +2,5 MT and equipped with tight flanges protecting the interface of the polyurethane bonding with the cast iron rim from any acidic splashes or washes.

On the drive unit

As the Prayon tilting pan filters consumes a very small power to run even at 2 min per rev, a 37 Kw electrical motor is more than enough to drive such a 300 SQM filter which should only consume 65 to 70% of this value. At that power level, it is quite easy to find on the market, at attractive prices, suitable frequency inverters gear boxes and couplings.

On the inverting track

Low acceleration/deceleration tracks will also be easily designed for such a 300 SQM filter as with the same rules used for the design of the smaller 30 pans filters (247 SQM) as the pans will be more or less of same surface and sizes. In addition, the 247 SQM tilt arms already fitted on the Prayon filters over 180 SQM (1940 SQF) will be used without changes.

On the slurry feed and cake wash boxes

Here again, the proven design of these parts with two feeding lines is applicable knowing that the length has to be adapted to the pan length.

4. State of the art for the new TDI Prayon filters (picture n°5)

Today, 2 filters of 75 SQM (810 SQF) are in operation respectively since July 2003 at the PFI phosphoric acid plant (Kavala – Greece) and since September 2006 at the Imacid – plant (Jorf Lasfar Morocco).

Two other filters, of 90 SQM (970 SQF) have been sold produced and shipped to two different customers. In Principle, the erection of these machines is planned end of 2007.

Compared to the classical tilting pan Prayon filters, it was interesting to develop such a typical filter particularly recommended for the replacement of old rotating filters and because a new TDI filter can be installed on the existing filter base plates and bring 30 to 50% of additional surface and because the capital cost for such a machine is quite competitive if compared with the classical Prayon filter.

In addition, the number of mechanical moving parts has been drastically reduced with also a beneficial impact on the maintenance cost and on the power consumption; for instance a 90 SQM TDI filters counts only.

- One tilt roller per pan.
- 10 support casters (able to be with 6MT).
- 10 centering rollers.
- One pan bearing fitted with 2 inside roller bearings.
- One single double web car frame equipped with a stainless steel bolted wear plate.
- One drive unit powered by a 7.5Kw electrical motor.

On the process view point, the filtrate draining time is very short due to the 4 slopes of the pans and to the appreciable height difference between the pan outlet and the distributor manifold inlet.

According to the experience, no dilution in the product acids has been observed. The cloth wash is improved as the distance between the cloth and the sprayers is remaining short and constant during the whole washing. Due to that fact, the cloth is better washed as well as the pan bottom which receive a bigger amount of water which then, flows downwards more efficiently on the pan bottom.

5. Developments planed to reach 130 useful SQM. (1400 SQF)

- The valve of an existing. Classical 24-110 Prayon Filter can used.
- The number of pans will remain unchanged (24) as well the general design (4 slopes).
- The tilt roller used on the 24-90 TDI filter can be used.
- The pan bearing will be equipped with bigger roller bearings.
- The radius of the single car frame double web ring will be increased as well as the resistance section.
- The number of support casters (GMT) will be increased up to 12 units.

CONCLUSIONS

- The fact to design and manufacture the biggest rotating vacuum filters in the world has certainly been a great challenge for the whole Profile Team.
- The birth of the first Prayon TDI filter in 2002 followed by 3 others sales have also been a fantastic and exciting experience.
- In the opinion of the writer, both Prayon filters types can still grow in the frame of future potential phosphoric acid projects or in other filtration applications.

Picture n°1



30-165EE Prayon filter (225 SQM in semi wet discharge) boosted up to 247 SQM (2660 SQF) in wet discharge for the OCP – BUNGE project.