MODIFIED WEAR PLATE AND SEALING ARRANGEMENT FOR VACUUM FILTER VALVES

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Abstract

Improvements to the Umzimkulu vacuum filters are described. In particular, modifications to the vacuum filter valves improved vacuum at the screen/mud interface and reduced the pressure losses between the filter and the filtrate receiver, resulting in better filter efficiency and lower pol losses in cake. These modifications incorporate a wear pad between the static and rotating heads, designed with a number of "O"-ring type seals.

Introduction

The advent of the rotary vacuum filter during the early 1930's provided mills with a relatively simple and convenient method of treating subsider muds.

It has never been suggested that the rotary filter was a perfectly efficient unit in mud filtration. The method by which the filtercake is built on the screen inevitably results in some muddy filtrate being returned to process. The factors which affect the extraction of residual pol from the juice in the cake require careful attention, if losses from this cause are to be maintained at an acceptable level. For a successful filter station, mud solids retention must be maintained at a satisfactorily high standard, permitting the pol lost to be kept at the lowest economic level. These factors are bound up in the capacity of a given filter (kg mud per sq metre screen area) and the mechanical condition of the machine including ancillary equipment such as vacuum pumps and filtrate pumps.

Investigation

Technical details of the vacuum filter station are given in table 1.

Table 1

Technical details of UK vacuum filter station

No of filters		:	4
Make		:	2 × Oliver and 2 × Eimco
Length	1.	:	3,660 m (O)
	2.	:	3,660 m (E)
	3.	:	3,660 m (E)
	4.	:	4,880 m (O)
Diameter		:	2,440 m
Speed of rotation		:	15 revolutions/hour
Screen area - total		:	125 m²
Mud Handling		:	83-96 kg/m²/hour
Vacuum Pumps Make		:	Sihi liquid ring
Type		:	Rotary - LPH 8655
Capacity		:	42 m³/minute
Motor		:	90 kW (735 rpm)

Historically below standard performance of the UK filter station prompted an investigation into the following areas of vacuum filtration:-

- Mud mixing and feeding
- Bagacillo supply - quality and quantity
- Vacuum pumps - capacity and operation
- Velocities - air and juice
- Piping sizes relative to adequate velocities
- Filtrate pumps
- Mechanical aspects including vacuum heads

Each of these areas should be discussed in its own right, however it is sufficient to say here that mud mixing, feeding and bagacillo quantity and quality were all improved upon in one way or another.

The vacuum pump is theoretically capable of extracting 42 m³ air per minute at - 70 kPa. For the filtering area available, this means a rate per unit area of 0,347 m³/minute/m², which is considered sufficient providing the pump is operating under design conditions.

The vacuum manifolds (filtrate piping) were all undersized. Filtrate flows through the same pipe as the air in these manifolds and so must also be considered in velocity calculations of this nature. The filtrate takes up a certain portion of the cross-sectional area of the pipes as well as having the effect of retarding the air velocity due to friction and turbulence.

An acceptable standard for fluid flow (filtrate) in vacuum piping is a 40% wetted perimeter. All filtrate piping should therefore be scaled up by this percentage.

According to most vacuum pump manufacturers[1] the air velocity in a vacuum manifold should not exceed 23 m/second. Filter manufacturers[1] specify a vacuum capacity of between 0,30 and 0,45 m³/minute of air required per square meter of filter area.

The gradient in filtrate piping is also important. Even though the size may be of the correct dimensions, surging can still take place due to inadequate grading or lack of grade altogether between filter and receiver. A grade of 1 : 90 has been found adequate in the gold mining industry.[1]

Any increase in pressure (bearing in mind that negative gauge pressures are being considered) between filter and filtrate receiver will result in a proportional loss of efficiency. Special attention should be paid to the possibility of mechanical air leaks in the following areas:-

(i) Damages screens
(ii) Behind screens inside drum
(iii) Internal piping
(iv) Expanded ends inside rotating vacuum head
(v) Gap between rotating/static vacuum heads
(vi) Lubricating points
(vii) Vacuum hose connections
(viii) Valves
(ix) Filtrate piping
(x) Filtrate receivers and float head valves
(xi) Filtrate pumps

One aspect of mechanical leaks which necessitated urgent modifications at Umzimkulu (UK), was the static/rotating heads interface. Improving the normal friction seal resulted in less pressure drop between filter and filtrate receiver and

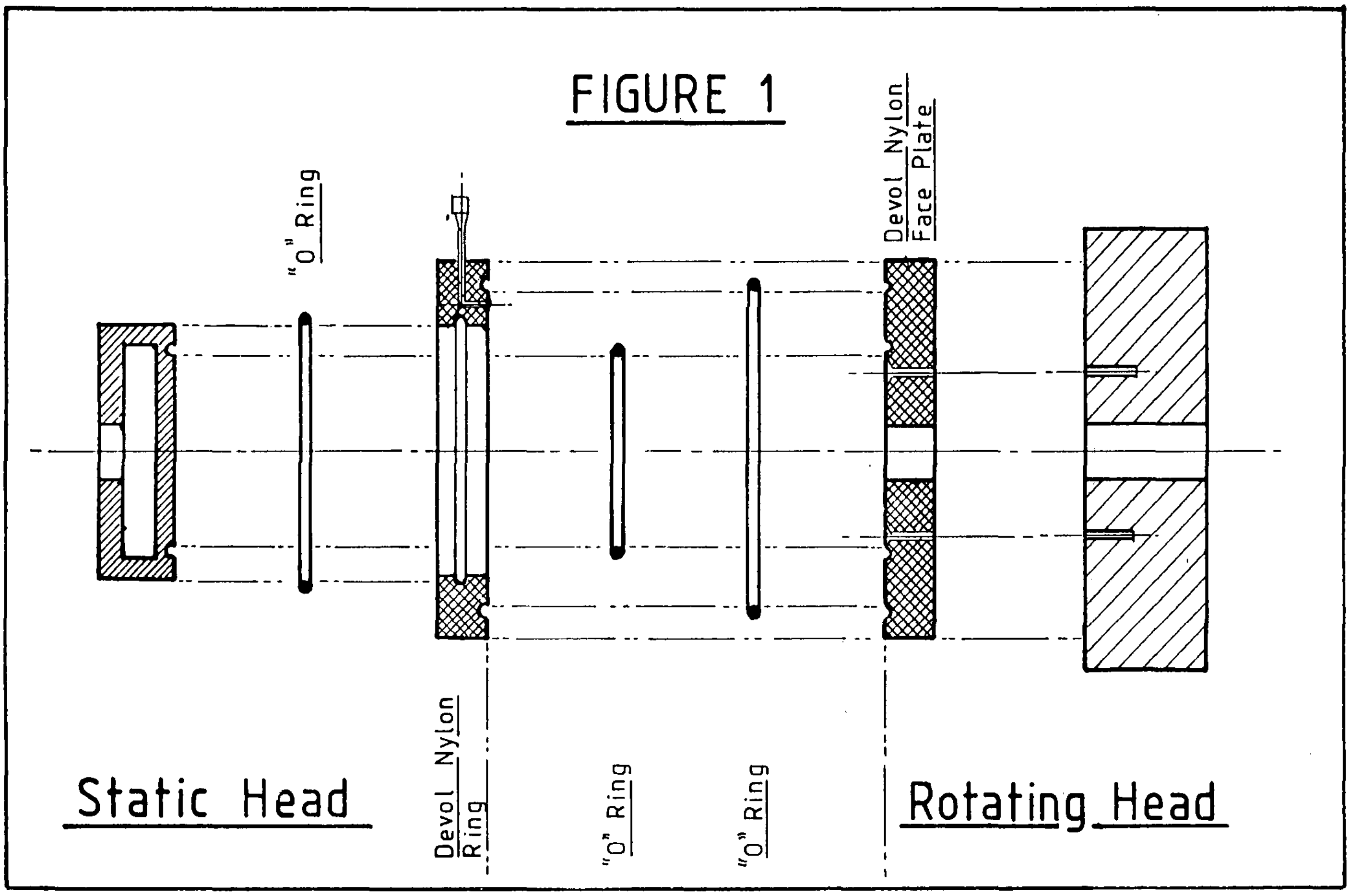

FIGURE 1 Diagram of vacuum head.

an overall increase in filter efficiency. The modifications made are described as follows:

Filter Vacuum Head Modifications

The vacuum head is made up of two parts:

The rotating section attached to the end of the drum journal and the static section to which the filtrate piping is attached, as shown in figure 1.

The static head (brass) was faced off on the lathe and a 6 × 3 mm deep groove machined into the face, 3 mm from the outside edge.

This head was then machined to allow for a nylon ring to be pressed over it. The nylon ring was 25 mm thick, effectively increasing the diameter of the static head by 50 mm.

The nylon ring face was then machined true to the face of the static head, with a 6 × 3 mm deep groove 10 mm from the outside edge. Having dowelled the nylon ring to the brass head, two grease ways were drilled from the outsided edge into the 6 × 3 mm grooves. Grease pots were fitted.

A nylon disc, with a similar outside diameter to the ring, was then screwed to the rotating head and the vacuum ports drilled through. Two grooves, 6 × 3 mm deep, were then machined into this disc with the same diameters as those on the static head. "O"-rings (6 mm) were fitted into both grooves and the two heads placed together in position and the tension spring and nut fitted.

The material selected for these wear discs was 22 mm thick DEVOL NYLON, a self lubricating compound obtainable from a number of local suppliers. Total cost per head (including labour) was approximately R300,00.

Conclusion

The modifications were found to reduce the pressure drop in the vacuum system and thereby to improve the filter efficiency. The simplicity of the redesigned heads sealing interface and the fact that all the work involved can be done in the normal mill workshop, makes the modification feasible for any mill.

REFERENCES

1. Quarterly General Meeting of the Association of Mine Resident Engineers (17/10/1982).