ON PREDICTIVE CONTROL USING THE VIBRATION DETECTION METHOD ON CONDESATION DAMAGE TO THE MULTISTAGE 2 ROTORS CENTRIFUGAL PUMP MACHINE WITH FRONTAL SEALING

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Article history:
Received: 10.06.2013; Accepted: 20.09.2013.

Abstract: *Loss of sealing and decommissioning of the front seal can be progressive when the rate of loss is considerably increased, or no signal when the flow is low to medium lethal, combustible, explosive or when the rate increases considerably, without signs of abnormal operation of the pump. For this reason, research on the seal during normal operation is necessary. Industrial applications preferably use vibration analysis method.*

Keywords: seal,front, vibration,pump

INTRODUCTION

Centrifugal pumps petrochemical be fitted in 90% with condensation. It requires that the face seal to work without fault and with little or no loss flow losses. Experimental observations in some dynamic petrochemical equipment, the maintenance forecasting show that sustainability front seals increased 2-3 times more than in the 1990-2000.Mentenanţa predictive is a system that is based on the possibility of predicting the timing of a system failure follow the variation of certain sizes, which at one time constitutes, signature" of that machine. In industrial applications, especially in the petrochemical industry has preferred to use vibration analysis method.

GENERAL PROBLEMS REQUIRING RESEARCH CONDESATION

Many pumping applications are dangerous because fluids are toxic and flammable, explosive or extremely cold or hot, causing gaps when not sealed properly. It is therefore essential that the face seal to work without fault and with little or no loss flow losses. In operation, the seal is subjected to operating parameters known, but may appear random factors that seal must respond. Remember random factors: human error, improper initial installation, operation without pumping environment, failure of auxiliary power systems coolant repeated starts and stops.

It is quite difficult to obtain data on seal failure. Manufacturers determine the degree of wear condensation by testing different combinations of materials for the products pumped to obtain levels of intensity of wear or environmental sustainability expressed by the seal.

The separation of the two rings consisting of the sealing and / or blocking the product is complex since the tribological point of view, due to the very small thickness (1-2 μm). That need further study in terms of tribological for sealing function

An indication of the type of fault may be obtained by control of operating parameters and the nature of the record losses. Precise identification of the fault can only be achieved by careful examination of the parts replaced, determining and possible ways of limiting losses.

EXPERIMENTAL RESULTS ON THE FRONT SEAL WEAR

The occurrence of a fault causes the pump to stop his disposal. This often involves disassembling the pump. If the pump has been operating longer with reported failure, face seal wear resulting poor working conditions which may be significant or primary seal destroyed. Careful analysis of the seal front leads to two solutions: complete refurbishment or replacement.

The monitoring and analysis of inspection reports from a petrochemical company follows the causes that led to the deterioration of mechanical seals in centrifugal pumps analyzed common front,figure 1

Location	Name	Items	Vibrations	Normal wear while	Stationary long	Impurities	Repair inconsistent	Chemical corrosion	Cavitation	Product crystallized	Pump blocked
100P104 A	Cartridge mechanical seal	1	1								
100P104 R	Mechanical seal	1		1							
100P12A	Mechanical seal	1		1							
100P12R	Mechanical seal	1			1						
100P13A	Mechanical seal	1				1					
100P13R	Mechanical seal	1			1						
100P1A	Mechanical seal	1				1					
100P1R	Mechanical seal	1					1				
100P21R	Mechanical seal	1		1							
100P2R	Mechanical seal	1		1							
100P4A	Mechanical seal fixed ring	1				1					
100P8A	Mechanical seal	1		1							
130P1R	Mechanical seal	1		1							
130P4R	Mechanical seal	1		1							
130P7R	Cartridge mechanical seal	1		1							
130P9R	Mechanical seal	1	1								
135P13A	Right single spring mechanical seal Ø 32	1				1					
135P8A	Mechanical seal	1							1		
147P0B	Mechanical seal	1		1							
147P3R	Mechanical seal fixed ring	1				1					
200AP2 A	Mechanical seal fixed ring	1				1					
180P22A	Mechanical seal	2		1							

180P24A	Mechanical seal fixed ring	1				1					
180P2A	Mechanical seal	2		2							
180P3C	Mechanical seal J. C. - refurbished	1		1							
180P4A	Mechanical seal J. C. - refurbished	1		1							
180P6R	Cartridge mechanical seal	1		1							

Figure 1. Causes damage seals

It can be easily seen that the first four possible causes (beyond normal wear) that led to the front seal damage are impurities in the product - 18%, stationary long - 15%, cavitation - 1%, vibrations - 1%, figure 2

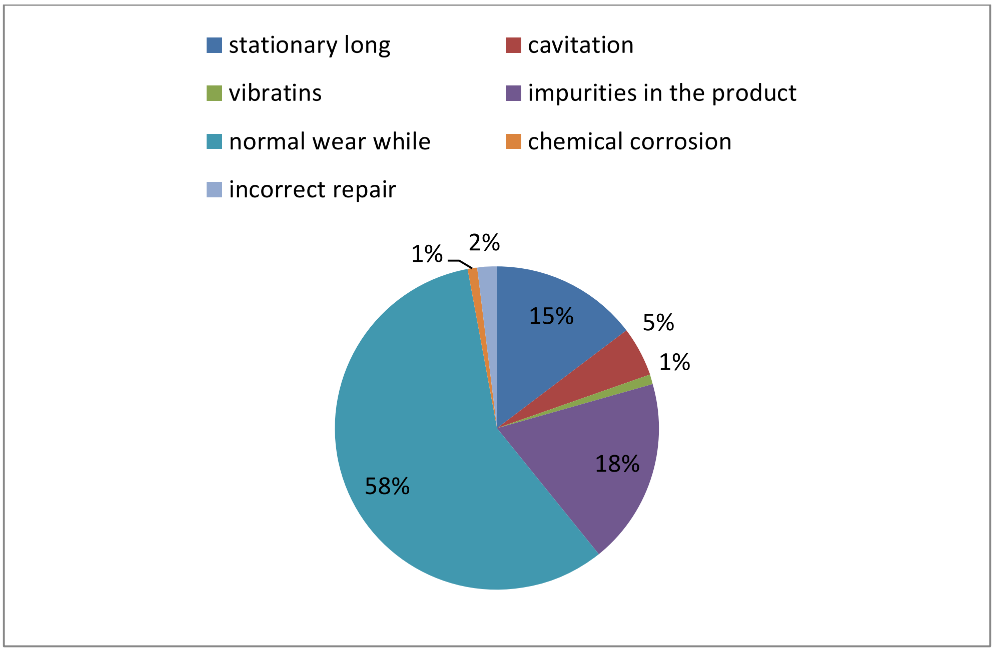

Figure 2. Causes leading to damage the front seal

The first three causes accounted for 35% of the percentage values are technological problems that lead to the need for discussions with the departments involved, to increase the reliability of the technical process. The chart shows that the percentage of normal wear time is 58%, which means that the problems raised responsible company should be respected.

All these observations have revealed the company where maintenance interventions are based on correct technique. Predictive Maintenance is a maintenance system that is based on the possibility of predicting the time of failure of one system by tracking the variation of certain sizes.

The petrochemical industry has preferred to use vibration analysis method

Activity vibration analysis is usually done in the maintenance department or safe operation centers, where we quantify the reliability of equipment.

Along with control faults causes through predictive maintenance, reliability program should be made to determine and diagnose faults, and to order the commencement of maintenance actions to remedy the situation or at least draw attention to the risk to continue operating under these conditions.

EXPERIMENTAL RESULTS ON PREDICTIVE CONTROL METHOD USING FAULT DETECTION USING VIBRATION TO MULTISTAGE CENTRIFUGAL PUMPS WITH TWO ROTORS FP19

The face seal assembly operates centrifugal pump consists of the drive shaft equipped with the pump sub-assembly in which the face seal and a clutch connecting the electric motor which drives the pump [3]
Vibration measurements made at the point shown in figure 3, shows increased values compared to the previous one, the reaching of the alarm vibration (measured value 7.5 mm / s)

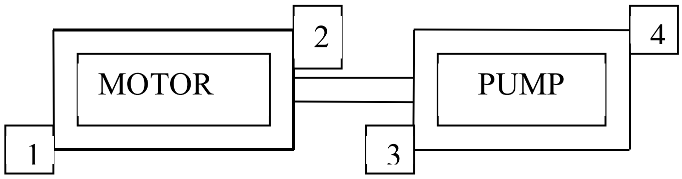

Figure 3.Vibration measurement points

Careful monitoring of the machine, from the point of view of vibration and operating parameters shows that after three months it had reached a value of 11.8 mm / s This can see below the list of measurements for each point of the machine vibrations, figure 4

Point	Direction	Value	U.M.	Change
1	Horizontal	252	g's	
1	Horizontal	1,28	mm/sec	--
1	Vertical	1,38	mm/sec	--
2	Axial	1,52	mm/sec	--
2	Horizontal	418	g's	--
2	Horizontal	1,53	mm/sec	--
2	Vertical	1,11	mm/sec	--
3	Axial	8,13	mm/sec	--
3	Horizontal	,137	g's	--
3	**Horizontal**	**11,8**	**mm/sec**	**--**
3	Vertical	7,44	mm/sec	--
4	Horizontal	,337	g's	
4	Horizontal	9,2	mm/sec	--
4	Vertical	9,84	mm/sec	--

Figure 4.List before remedying fault vibration measurements

Spectral analysis shows a misalignment of the whole rotor (shaft - rotors) in the pump body bushing wear due to the central of the two rotors. In the spectrum analyze, an occurrence of the maximum amplitude (9.23 mm / s) at the fundamental frequency of the machine (1xrpm = 2880rot/min) Figure 5.This fundamental frequency generates misalignment defects and / or imbalance.

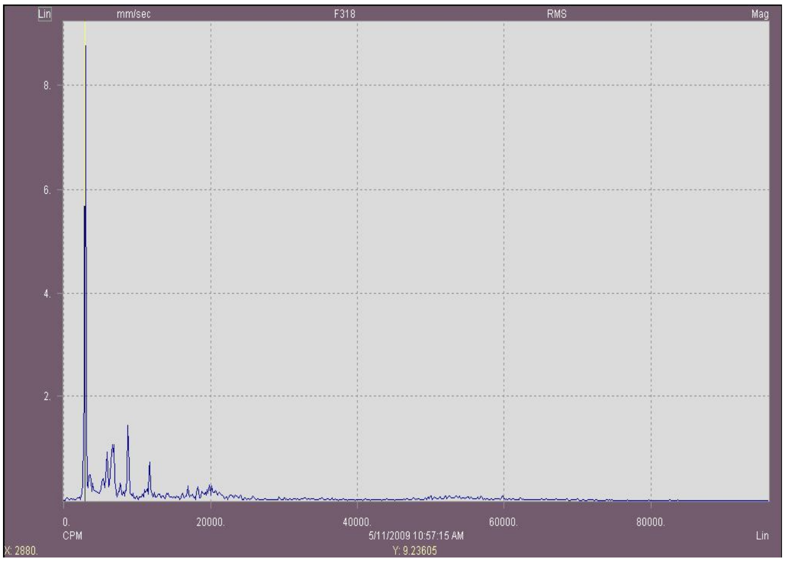

Figure 5. Spectral analysis before the fault rectified

For an accurate analysis of the defects of a machine, it is very important to know the time evolution of a vibration values (highlighted by trends) and data / information on technological parameters, any system crash (electric shock / shock technology, etc.) . These aggregates can lead to more accurate diagnosis of the defect. Vibration values were increasing, which means that the defect had increased over time (wear in development). When removing the pump was found that the central hub of the two rotors were worn, the rotor being misaligned in the pump body.

After replacement and alignment machine was rebooted.Vibration values measured after one month showing a decrease from 11.8 to2.0 mm / s, figure 6.

Point	Direction	Value	U.M.	Change
1	Horizontal	.197	g's	
1	Horizontal	.828	mm/sec	--
1	Vertical	.992	mm/sec	--
2	Axial	1,61	mm/sec	--
2	Horizontal	294	g's	--
2	Horizontal	1,23	mm/sec	--
2	Vertical	1,09	mm/sec	--
3	Axial	1,62	mm/sec	--
3	Horizontal	,183	g's	--
3	Horizontal	1,98	mm/sec	--
3	Vertical	2,44	mm/sec	--
4	Horizontal	,472	g's	
4	Horizontal	1,83	mm/sec	--
4	Vertical	2,01	mm/sec	--

Figure 6.List vibration measurements after fault rectification

Spectral analysis performed, figure 7, has not revealed the existence of the maximum amplitude at the fundamental frequency (1xrpm), which denotes that the defect was correctly diagnosed and removed.

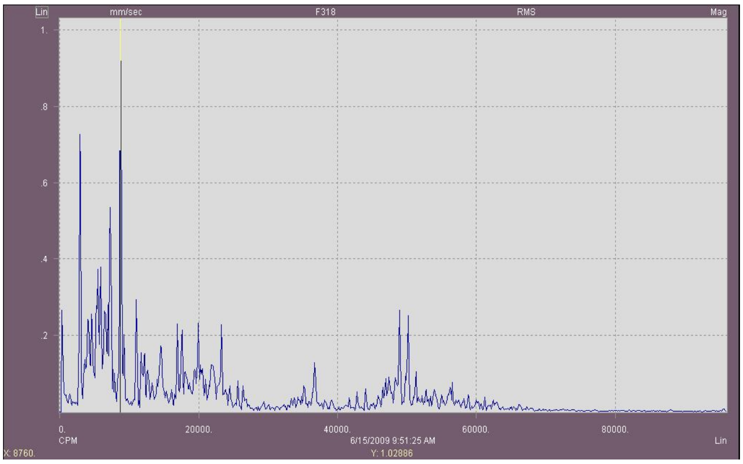

Figure 7.Spectral analysis after fault rectification

In figure 8 represents the evolution of vibration both before surgery and after surgery. Note the disappearance of the last fundamental amplitude spectrum (top right) and the evolution of "down" the overall vibration after repair value (bottom right).

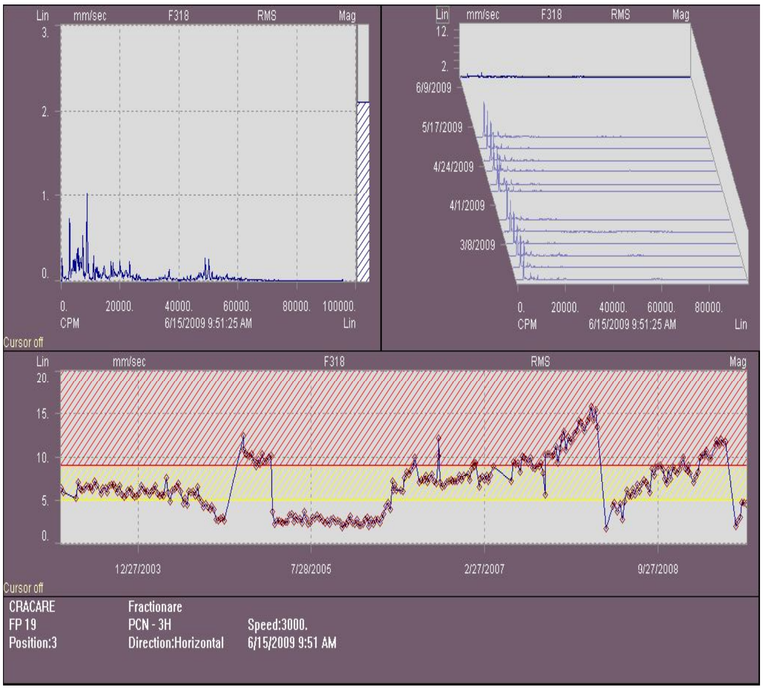

Figure 8.Evolution of vibrations before / after repair

The yellow color indicates the alarm limit and limit red danger (machine entered after repair limit danger and returned to normal operation).

CONCLUSION

Bushing wear was the main cause of high vibration machine operation. Low frequency vibrations affect both the bearings for pump and seal,figure 9. Dismantling found both in bearing wear and the seal.

Figure 9. Seal damage

To repair this pump was necessary to replace the central hub, bearings and seal and rotor assembly balancing and alignment.

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