PRACTICAL STUDY OF THE INFLUENCE OF LOAD FLOW ON THE CYLINDRICAL AND POLYGONAL SIEVES

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Abstract: Experimental research has established conditions under which one sieve can achieve optimum volumetric ranking efficiency. A direct influence in terms of efficiency of these machines has the material load flow in the sieve. The size of this flow may influence the proper functioning of sieve and of course, its operation in the optimal screening condition, that is perpendicular moving of the load to the surface screening. In addition, a great influence for the sieving efficiency it has the grain size of the material that it is to be sorted, the angle of inclination for the rotor axes, the speed of rotation for the rotor, the properties of the screening surface.

One of the most important influences is the geometrical form of the rotor section. A series of experimental research was made for a rotor with a cylindrical form, and for a rotor with a hexagonal form. In this article, is presented some of the data that results from the study for the load flow influence, for the cylindrical sieves and for polygonal sieves.

Keywords: screening, sieve, volumetric ranking

1. Introduction

The castings surface quality is directly influenced by the characteristics of materials that go into moulding sand, especially sand.

To obtain a grain size of sand that meets the requirements of the finished product, different machines are used for this screening.

Below is a summary of some results obtained with the help of a pilot installation research over volumetric sieving.

These results shows, among other information, the influence of the material load flow over sieving efficiency.

It is considered ranking efficiency ratio of the quantity of material that passed through the area classification (allowed) and the amount of Load flow influence on sieving installation performance

When the material load flow was adjusted with breech plan, mounted at the base of the material bunker. It was practically established the link between openness from the bunker base and the load flow area provided to screening plant.

2. Load flow influence on sieving installation performance

For this research were used as follows:

- A pilot installation tested in normal operating conditions (figure 1).
- Dredged sand, with average grain size (M50) 0.2, semi-fine grained (experimentally determined) (figure 2).

The pilot plant for research reproduces exactly an industrial plant for sand ranking with the addition that it can be controlled the speed and flow. It can also be changed drum sieve.

Figure 1. The pilot plant for research

Figure 2. Career sand used in research

The material load flow was determined: using the theoretical relationships of specialized textbooks [1, 2, 3] and with the experimental research material that could pass through the area classification (allowed + refused material).

Table 1.Theoretical load flow values and experimental load flow values on the rotor speed 37 rpm

Test data /Section for load flow passage	cm^2	5.87	7.05	8.22	9.4	10.57
Experimental load flow values	Kg/s	0.154	0.194	0.259	0.279	0.31
Theoretical load flow values	Kg/s	0.23	0.3	0.37	0.45	0.51

The differences between theoretical and experimental values of load flow are mainly due to load friction on the bunker walls, also because the horizontal adjustment used to control the values of the load flow, and because intergranular friction of material.

Research has been done considering changing value section of the bunker openness from 4.7 cm^2 to 11.16 cm^2. The pilot plant has the possibility to regulate speed using a rheostat. It was chosen 14 contact points for the rotor speed in the range 11 - 60 rpm.

Sieving efficiency is also affected by shaft rotation or inclination of the surface screening. This shows that if higher inclinations are applied of the shaft, sieving efficiency decreases [4, 5]. The main cause for this is material load axial displacement and pushing it to evacuation through rejection chute.

Table 2. Sieving efficiency with rotor speed and load flow variables, and with shaft inclination from 0 degrees to 5 degrees, on the cylindrical rotor

Sieving efficiency, cylindrical rotor										
Rotation rpm	Shaft inclination 0 degrees			Real load flow [kg/s]		Shaft inclination 5 degrees				
	0.083	0.1548	0.1945	0.2223	0.2596	0.083	0.1548	0.1945	0.2223	0.2596
24	99.61	99.35	99.16	99.3	98.7	98.71	97.8	97.39	96.1	95.25
29	99.23	98.22	98.1	97.9	97.55	98.07	97.47	96.72	95.85	94.95
33	98.85	98.18	98	97.5	97.2	97.74	96.15	96.06	95.7	94.8
41	98.6	98.1	97.8	97.2	96	97.32	95.58	95.48	95.12	94.65

It is noticed a decrease in screening efficiency with increasing speed of rotation of the rotor drum sieve.

This phenomenon is explained by involvement of material through evacuation chute, with the material that is considered refusal, due to axial displacement of the load speed. In addition, the sieving efficiency values decreases with the increasing values of the load flow of the installation. It is considered that there is an optimum value of the material load flow of the installation.

From the diagrams 3 and 4 are find the optimal values for the screening efficiency of the sieve: 0.083 kg / s at 0° inclination shaft.

Table 3. Sieving efficiency with rotor speed and load flow variables, and with shaft inclination from 10 degrees to 15 degrees, on the cylindrical rotor

Sieving efficiency, cylindrical rotor								
Rotation rpm	Shaft inclination 10 degrees				Shaft inclination 15 degrees			
					Real load flow [kg/s]			
	0.083	0.1548	0.1945	0.2223	0.083	0.1548	0.1945	0.2223
24	98.39	97.59	94.21	93.15	95.2	94.03	93.15	92.1
29	96.75	95.66	93.2	91.9	94.9	92.58	92.15	91.42
33	95.12	93.74	91.9	91.8	93.38	92.13	91.52	91.26
41	94.72	93.1	91.62	91.1	93.18	91.65	91.5	90.2

For hexagonal rotor, results are slightly different. With increasing of rotor speed, sieving efficiency increases, because the material path has a direction perpendicular to the surface of sieve (or very close to the perpendicular direction). However, increasing the values of load flow decrease the efficiency of screening, because the rest of the material remain at the bottom of the screen and stop the material to pass through the surface of the sieve. An important factor that is directly related to ranking efficiency is rotor tilt.

Granularity of the sand generally affects both volumetric ranking process and mixture preparation processes and production of forms. Experiments were done in conditions in which supply flow, and rotation speeds of the rotor are variable.

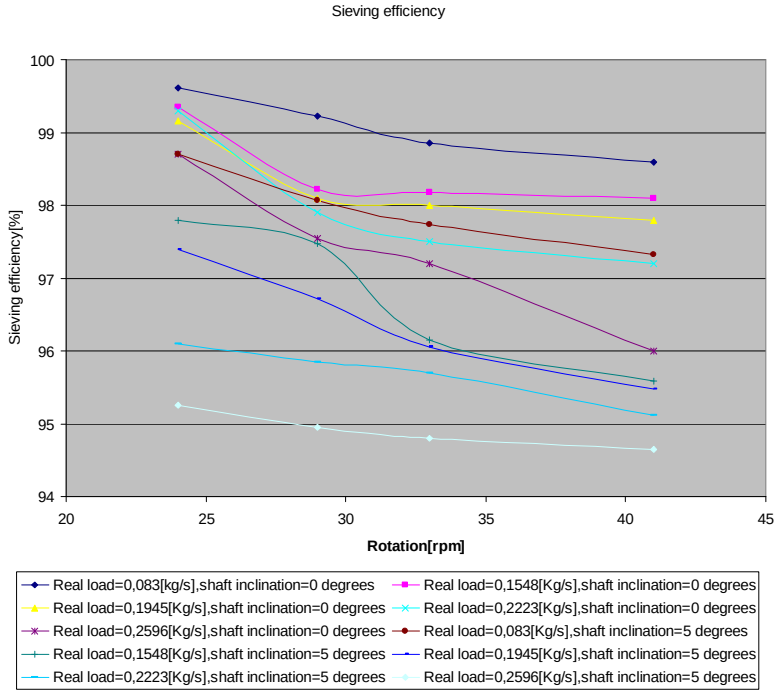

Figure 3. Sieving efficiency with rotor speed and load flow variables, and with shaft inclination from 0 degrees to 5 degrees, on the cylindrical rotor

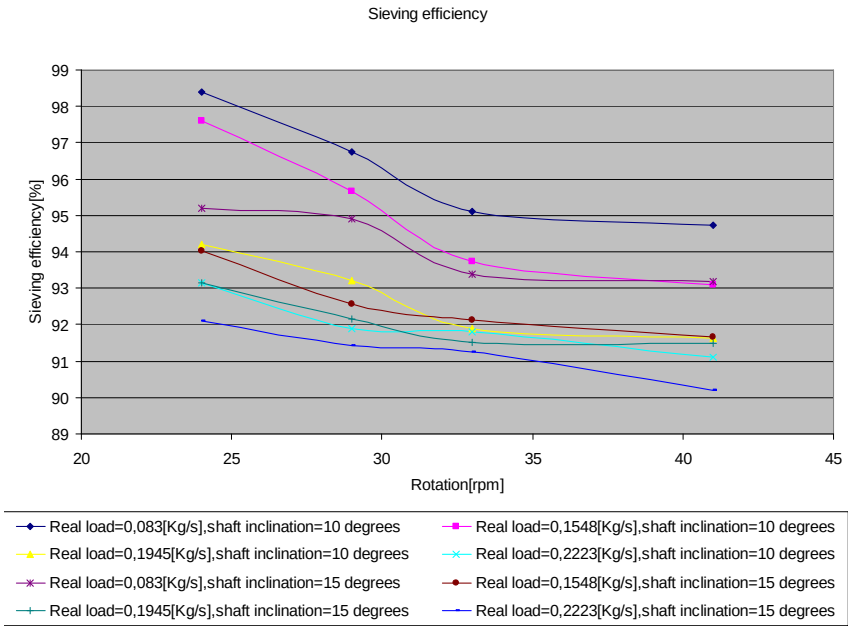

Figure 4. Sieving efficiency with rotor speed and load flow variables, and with shaft inclination from 10 degrees to 15 degrees, on the cylindrical rotor

Table 4. Sieving efficiency with rotor speed and load flow variables, on the hexagonal rotor

Sieving efficiency, hexagonal rotor				
Rotation	Real load [Kg/s]			
rpm	0.1548	0.1945	0.2223	0.2596
24	92.4	90.1	87.6	85.42
29	93.6	90.12	88.14	86.53
31	96.97	95.02	93.4	92.84
39	97.64	95.42	94.33	93.94
41	98.28	97.8	97.09	97.46
49	99.48	99.2	98.14	97.89

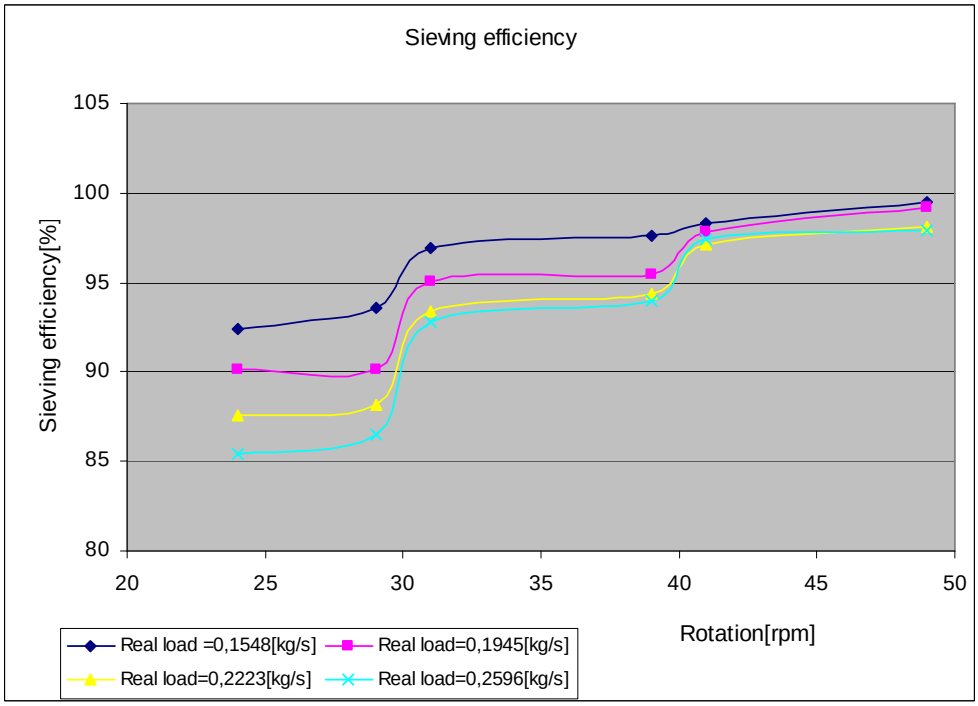

Figure 5 Sieving efficiency with rotor speed and load flow variables, on the hexagonal rotor

3. Conclusions

For each type of sieve is necessary to establish screening efficiency values, based on the material load flow and geometric characteristics of the drum.

It is recommended that the flow of load values to be chosen in such way that to achieve optimal screening condition.

From the experiment research we found the optimal values for the screening efficiency of the sieve: 0.083 kg / s at 0 ° inclination shaft, for the cylindrical rotor, and for hexagonal rotor the good values of the screening efficiency are :the load flow 0.1548 kg/s .

In addition, it is obvious that the rotation values have an important point of view. For the cylindrical rotor the increasing of the rotation values goes to decreasing of screening efficiency.

For the hexagonal rotor, the sieving efficiency values increases with high values of rotation, because the material path has a direction perpendicular to the surface of sieve (or very close to the perpendicular direction).

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