14th International Research/Expert Conference
”Trends in the Development of Machinery and Associated Technology”
TMT 2010, Mediterranean Cruise, 11-18 September 2010

THE INFLUENCES OF THE CYLINDER SIEVES AND THE LOAD FLOW OF GRAIN MATERIAL OVER THE VOLUMETRIC RANKING EFFICIENCY

Drd. Ing. Apostu Elena Diana
’’Transilvania” University of Braşov
B-dul Eroilor nr. 29, 500036, Braşov
România

ABSTRACT
The grain material quality which is obtained with the volumetric ranking process have direct influence over the properties of the forming material and of course over the moulding form.
Researchers from this field of activity are concerned to obtain good results for the volumetric ranking productivity.
It is made a series of experiments with a pilot installation ,a cylinder sieve,with many adjustements possibilities.These experiments show the influences of the cylinder sieves revolution and the influences of the load flow too.Also can be observed the influence over the rightness of the ranking process.

1. THE MATERIALS USED IN RESEARCH [2, 4]

For this research were used as follows:
- A pilot installation tested in normal operating conditions.
- Dredged sand, with average grain size (M50) 0.2, semi-fine grained (experimentally determined)

1.1. The pilot installation used in research

The pilot installation has the following components:
- a bunker for storage and delivery material, with an adjustable opening for material flow (Fig 2)
- a feed chute of the rotor
- three different rotors: one cylindrical,one truncated hexagonal pyramid and one truncated cone , each of which can be fitted with three different dimensional surfaces for ranking.
- allowed material discharge chute (Fig.1)
- non-material discharge chute (Fig. 1)
- a rheostat, which provides adjustment of rotor speed control grid,
- DC-electric motor with power of 100 W.

The training of the installation is directly through a simple gear.

Figure 1. Parts of the pilot installation

Figure 2. The bunker for granular material

1.2. Dredged sand [1]

For this research we used quarry sand,gray color,washed and dried in advance with average grain size (M50) 0.2, semi-fine grained.

Granularity of the sand generally affects both volumetric ranking process and mixture preparation processes and production of forms.

2. LOAD FLOW INFLUENCE ON VOLUMETRIC RANKING EFFICIENCY

Load flow of material was determined by calculations (theoretical) and practical (experimental). Researches were conducted on a wide range of values of cross section of bunker: from 4.7 cm^2 to 11.16 cm^2.

On each area value corresponds to a particular section of flow passage.

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]	UM	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.

Table 2. Efficiency values depening on the experimental load flow values

Test data /Section for load flow passage [cm^2]	UM	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
Ranking efficiency	%	99.46	97.84	96.34	91.68	74.6

It is considered ranking efficiency ratio of the quantity of material that passed through the area classification (allowed) and the amount of material that could pass through the area classification (allowed + refused material).

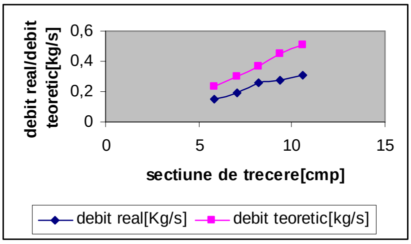

Figure 3. The link between experimental determined load flow and theoreticalload flow converted into graphic

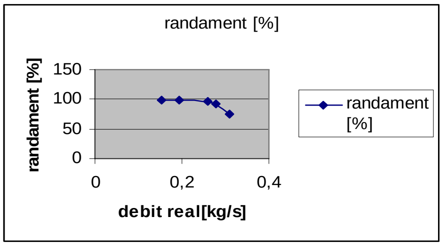

Figure 4. The link between experimental determined load flow and ranking efficiency converted into graphic

As is showed from the tables and graphs, when real load flow (experimentally determined) is reduced,the efficiency decreases ,because accepted material, can not pass through the surface of ranking process ,and is being evacuated along with the grading material that has been refused .

3. ROTOR REVOLUTIONS INFLUENCE ON VOLUMETRIC RANKING EFFICIENCY

Pilot installation is built in such a way that is able to have speed control, with the help of rheostatic device.
In this particular idea it has 14 contact points to allow adjustment of rotor revolutions, between 11 rot/min-60 rot/min.

Table 3. Values of rotor speed control depending on the contact points

Contact points	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Rotor speed[rot/min]	11	13.6	21	23.8	27.4	29	31.5	33	37	38.7	41	45	49.5	59.4
Motor voltage[V]	8.25	8.5	8.6	9.1	9.5	10	10.3	11.3	11.3	11.8	12.3	12.5	13	15

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Maintaining a constant flow (Qreal = 0.222Kg/sec) were chosen few points of revolutions and efficiency values were determined.

Table 4. Efficiency values depending on rotor speed

Rotor speed [rot/min]	11	23.8	27.4	38.7	41	45	59.4
Ranking efficiency [%]	72.11	89.67	92.99	94.25	97.00	97.07	98.39

The rotor speeds are taken from Table 3, optionally.
Efficiency values increase with increasing rotor speed control, because the material is discarded with a higher rate of detachment and has a path closer to the ideal trajectory, perpendicular to the ranking surface of the rotor.

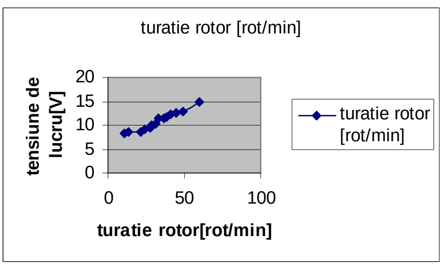

Figure5. Rotor speed depending on the points of contact / voltage

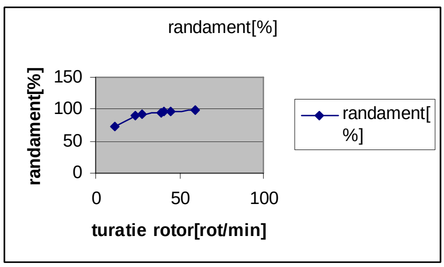

Figure 6. Ranking efficiency depending on rotor speed

When the process is reaching a critical speed value, specific to each installation,the detachment of material is no longer possible due to the action of centrifugal force .

4. REFERENCES

[1] Constantinescu ,Al.: “Utilaje pentru turnatorii”, Vol I, Universitatea Transilvania din Brasov, 1977
[2] Buzila S.: Proiectarea si executarea formelor, Editura Didactica si Pedagogica Bucuresti, 1976
[3] Apostu E.D.: Proiectarea, constructia si exploatarea utilajelor pentru clasare, Contributii personale, Referat doctorat, Universitatea ”Transilvania” Braşov, 2009