18th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2014, Budapest, Hungary 10-12 September, 2014

EXPERIMENTAL IDENTIFICATION OF DYNAMIC BEHAVIOR OF VIBRATING SCREEN IN COAL MINE SEPARATION DEPARTMENT

Nedeljko Vukojević, Fuad Hadžikadunić
Faculty of Mechanical Engineering
Fakultetska 1, Zenica
Bosnia and Herzegovina

Mustafa Imamović
ArcelorMittal Zenica
Bulevar Kralja Tvrtka I No.17, Zenica
Bosnia and Herzegovina

ABSTRACT
The dynamic behavior of two-storey vibrating screens for dry sifting is measured after its installation. The manufacturer of the vibratory screen is Vibratech, type VBS - 2D, which is installed in the RMU Breza - Separation plant, at a level of +25,0 m. The earlier screen "HEIN LEHMANN" type LS2 - 26DD is replaced by this vibratory screen. In order to determine the dynamic behavior of the screen, vibration measurements were carried out at five locations in the horizontal and vertical planes. The measurement results are compared with earlier measurements on a vibrating screen "HEIN LEHMANN" type LS2 - 26DD in order to determine the characteristics and assessment of the state during the operation of these two screens. The acceleration is measured in the vertical plane for the measuring point on a steel bracket vibrating screen, what is the same for these two screens. The objective of the measurement was to determine the effect of vibratory screen working on a supporting structure and as a comparative parameter is used acceleration data in vertical direction.
Keywords: vibrating screen, vibration measurements, operating conditions.

1. INTRODUCTION
The subject of analysis is the dynamic behavior of two-storey vibrating screen for dry sifting of manufacturer Vibratech type VBS-2D, Figure 2, which is installed in the RMU Breza - Separation plant at a level of +25,0 m. This vibrating screen replaces the previous screen "HEIN-LEHMANN" type LS2-26DD and is currently in test mode. During the testing period an intensive vibration has been occurred which caused excessive vibrations of the whole building. In order to determine the dynamic behavior of the screen vibration measurements were carried out at five locations in the horizontal and vertical planes. The measurement results are compared with earlier measurements on a vibrating screen "HEIN-LEHMANN" type LS2-26DD, Figures 1 and 2, in order to determine the characteristics and assessment of the state during the operation of these two screens. The objective of measurements is to compare the impact of operating vibrating screens on the support structure, and as a comparative parameter the acceleration in the vertical direction is used, [1,2,5].


Figure 1. Vibrating screen HEIN-LEHMANN


Figure 2. Vibrating screen VIBRATECH

2. EXPERIMENTAL MEASUREMENTS

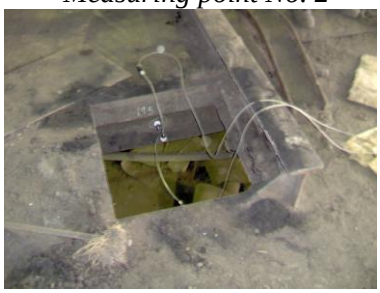
Measurements of the dynamic behavior of the vibrating screen Vibratech type VBS-2D was made in working conditions, Figure 3. Acceleration sensors were installed in two orthogonal planes at several measuring points. For data acquisition device is used Spider 8-55 manufacturer HBM, and data processing is done in software Catman Professional.

Measuring point No. 1

Measuring point No. 2

Measuring point No. 3

Measuring point No. 4



Measuring point No. 5

Screen in working condition

Figure 3. Measurement points

Measurements of acceleration on the vibrating screen after changes to the chassis are made only in characteristic measuring points in the most extreme operating conditions. These test points are selected based on the results of extensive measurements and analysis of the screens before the change of chassis and other facilities in different operating conditions, Figure 3. Cumulative results are shown in Tables 1 and 2. Measurements are made on the vibrating screen after changes to the chassis in the same place as in vibrating screen "HEIN-LEHMANN" type LS2-26DD, Figures 4 and 5.

Figure 4. Measuring procedure

Figure 5. Measuring points at the vibrating screen supports

Table 1. Comparative results of vibration measurements (acceleration) at the separation plant after and before the change of screen chassis

No.	Measu-ring point	Measuring point place	Description	Results acceler., m/s^2 after		Results acceler., m/s^2 before	
				Horiz.	Vert.	Horiz.	Vert.
1	M1-3	The horizontal steel I-profile parallel with the screen positioned on a concrete slab above extractor, Drew-boy device and single storey screen	Vibratory screen "ON", with material, other facilities at a level 22,0 m included	- 0,02 do +0,12	- 0,04 do +0,25	- 0,05 do +0,09	- 0,08 do +0,2
2	M2-3	The horizontal steel I-profile in crosswise position to the screen, positioned on the bridge over the extractor, Drew-boy device and single-storey screen	Vibratory screen "ON", with material, other facilities at a level 22,0 m included	- 0,07 do +0,02	- 0,05 do +0,3	- 0,02 do +0,1	- 0,13 do +0,13
3	M3-4	The horizontal steel I-profile parallel to the screen, positioned below the support grids	Vibratory screen "ON", with material, other facilities at a level 22,0 m included	- 0,07 do +0,2	- 0,5 do +0,15	- 0,125 do +0,12	- 0,15 do +0,4
4	M4-2	The vertical column at the connection place to the concrete slab near the vibrating screen	Vibratory screen "ON", with material, other facilities at a level 22,0 m included	- 0,02 do +0,12	- 0,4 do +0,4	- 0,05 do +0,14	- 0,4 do +0,15
5	M5-3	The horizontal steel I-profile parallel to the screen, positioned on the board with screen at a distance of approx. 4 m	Vibratory screen "ON", with material, other facilities at a level 22,0 m included	- 0,18 do +0,05	- 0,27 do +0,05	- 0,04 do +0,04	- 0,4 do +0,15

Table 2. Comparative results of vibration measurements (acceleration) for a new screen "Vibratech" and old screen "Hein Lehmann"

No.	Measuring place	Description	Vibrating screen Vibratech accel., m/s^2		Vibrating screen Hein Lehmann accel., m/s^2	
			Horiz.	Vert.	Horiz.	Vert.
1	Rear feet vibrating screen to a fixed structure	Vibratory screen "ON", with material, other facilities at a level 22,0 m not included	**-0,05 do +0,05**	**- 0,07 do +0,08**	**-0,04 do +0,06**	**- 0,1 do +0,17**

3. ANALYSIS OF RESULTS

Vibratory screen "VIBRATECH" VBS-2D is investigated under conditions when relying on the surface with and without the material where the other facilities were excluded (blank screen) and results show that the vibrating screen "Vibratech" during no-load operation has a relatively low level of acceleration. The greatest acceleration are during commissioning within -0.25 to +0.15 m/s2 as expected, whereas after reaching normal operating mode screens without load level changes acceleration decreases more than 50%. During exit from the working regime (screen stopping) level

of changes slightly increase. Vibratory screen "VIBRATECH" VBS-2D was tested in conditions when relying on the surface with the load where other plants included-normal operating conditions. Results are given in Table 1, rows 1 to 5. In the same conditions vibrating screen before replacing the chassis was investigated. Comparative results of measurements before and after modification of the chassis (Table 2) show that there is generally a reduction in the level of change of acceleration, except the place M4-2 where there has been a slight increase. These differences in values are insignificant because their level is low and as such can not cause apostleship vibration or vibration level that is hazardous to the overall stability of the supporting structure of the separation of coal mines "Breza". By analyzing the results of measurements of acceleration on support places of the vibrating screen "Vibratech" VBS-2D and old screen "Hein-Lehmann" type LS2-26DD that are tested in the most extreme case, when all the plants in the separation are in working condition and when the screen is under load, it can be concluded that the level of vibration for the case of "Vibratech" screen is lower than the old sieve "Hein Lehmann". The measured level of changes in acceleration of the vibrating screen "Vibratech" in the vertical plane are in the range - 0.07 to +0.08 m/s^2 while for the vibrating screen "Hein Lehmann" was in the range of -0.1 to +0.17 m/s^2 which is about 55% less. Significant impacts are expected only when accelerating is of level 2 m/s^2 and more.

4. CONCLUSIONS

After comparative analysis of measurement results of acceleration at supports of vibrating screens "HEIN-LEHMANN" and "VIBRATECH" it can be concluded that there are no significant differences in the dynamic influence on the structure. It is important to emphasize that the vibrating screen "VIBRATECH" has been tested in conditions when relying on the surface with and without load, but in a situation of basic supporting structure of the screen with less stiffness. Increasing the stiffness of the basic structure of the screen leads to increasing of their natural frequencies of structural response, and impairment of the value of the acceleration level, [3,4]. A detailed analysis of the dynamic operation of vibratory screens in separation deaprtment of coal mines "Breza" it can be concluded that the two-storey vibrating screen "Vibratech" VBS-type 2D has less vibration levels compared to the old screen "Hein-Lehmann" type LS2-26DD and it hasn't dynamically significant impact on the construction of the supporting structure of the separation plant building. In normal operation stage vibrating scrren does not cause unacceptably high levels of vibration.

5. REFERENCES

[1] Keller K., Stahl W.: Vibration Screens for dewatering – Theory and Practice, Minerals and Metallurgical processing, 1997.

[2] Yantek D. S., Kamargo H. R.: Structural Vibration as a Noice Source on Vibrating Screens, 2003.,

[3] Doleček V., Voloder A., Isić S.: Vibrations, Mechanical Engineering Faculty Sarajevo, 2009.

[4] Ismic Dž., Voloder A., Petrovic M.:Analysis of Dynamic Vibration Absorber Exposed to a Non-Periodic Complex Excitation, 17th International Research/Expert Conference "Trends in the Development of Machinery and Associated Technology" TMT 2013, Turkey

[5] http://en.vibratingscreen.net/vibrating-screen-theory-and-selection-pdf.html.