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RESEARCH OF NOISE IN TRACTOR K700 CABIN

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Abstract

This paper briefly describes method of noise-measuring tractor's K700 cabin, obtained noise spectres were analysed and recommendations based on these results for noise decreasing in cabin K700 are proposed. Air noise penetrates into the tractor's K700 cabin through panels, enclosures, apertures, chinks etc. Structural noise in the cabin is caused by vibrations transfer from sources along tractor frame through vibration isolators to cabin walls and carcass. At that, the main noise sources are engine case, air system, exhaust system, engine cooling system fan and also transmission case located under cabin floor. Every panel in the cabin has own intensity of sound waves radiation and thus contributes to forming of the sound field on the operator workspace. Therefore, it is important to know the sound pressure level near every panel into the cabin. It was state that at low frequencies, noise from left windshield prevails. In addition, in high frequencies bands the highest sound pressure issues from partition between engine area and cabin. Noise spectres have sound pressure peaks in bands with centre frequencies. Total noise level perceived by operator in tractor cabin is less during tractor motion on dirt road without aggregate than during its work with seeding machine on field prepared for winter grasp. At that, partition between engine area and cabin contributes greatly. Thus, for integrated noisiness, reducing in the tractor cabin sound isolation of partition between engine area and cabin should be increased and also sound isolation of windshields located closely to exhaust pipe has to be improved. To decrease low-frequency noise optimization of tractor cabin vibration isolation system need to be performed.

Keywords: *capital repair, sound pressure level, noise total level, noise spectre, tractor, cabin, measuring*

Lately most of the tractors "Kirovets" family exhausted its standard operation time in agriculture. It is caused by insufficient provision with new machines in farms. Thus, repair of old tractors is performed more often. In many cases that repair is determined by worn details and units. Sound- and vibration isolation materials, sound absorption surfaces and structural elements are often damaged and outwear. Need to research the noise in tractor's cabin on operator workplace appears after prolong exploitation and repair (including capital). Development of relatively simple measures for mechanics, farmers and repair organizations to decrease noisiness in the tractor cabin to sanitary standard should become final result. High noise level on operator workspace during tractor exploitation is one of the unhealthiest factors. Most of the engineers who involved in designing of vehicles cabin struggle with that factor for a long time.

Exceeding permissible norms noise level in tractor cabin [3, page 6] has a pernicious effect on operator's health and general state and also on work efficiency.

Noise effect on human is mostly assessed by means of the sound pressure level (SPL) and its frequency structure (noise spectre) [1, page 37].

Sound pressure in cabin is formed by penetrating (air), structural (vibration), reflected noise and noise from internal sources simultaneously [2, page 12].

Air noise penetrates into the tractor's K700 cabin through panels, enclosures, apertures, chinks etc. Structural noise in the cabin is caused by vibrations transfer from sources along tractor frame through vibration isolators to cabin walls and carcass. At that, the main noise sources are engine case, air system, exhaust system, engine cooling system fan and transmission case located under cabin floor. Every panel in the cabin has own intensity of sound waves radiation and thus contributes to forming of the sound field on the operator workspace [2, page 10]. Therefore, it is

important to know the sound pressure level near every panel into the cabin. Noise level was measured by means of PAA3 sound level meter in field conditions. The tractor K700A (#BH0216, in exploitation since 1986, details of conrod-piston group were changed) worked at second gear of forth mode (motion without tractor-drawn implements) and at first gear of second mode (motion with aggregate). Engine revs were hold constant in range 1700-1800 r/min. Microphone were installed at the distance 100-150 mm from the middle of every tested panel. Cabin glasses and doors were tightly closed. The tractor moved on the dirt road without aggregate, and with aggregate –on filed prepared for winter corp. At that seeding machine including 5 seeders was used (grasp width of each seeder is 2.1 m). Mass of seeds in the aggregate was 1500 kg. In every case place of experiment (in accordance with standard requirements) is free space where distance to big reflective objects was less than 50 m from tractor. Results of noise measurement at the workspace (microphone was installed at ear level height) are presented at Fig. 1.

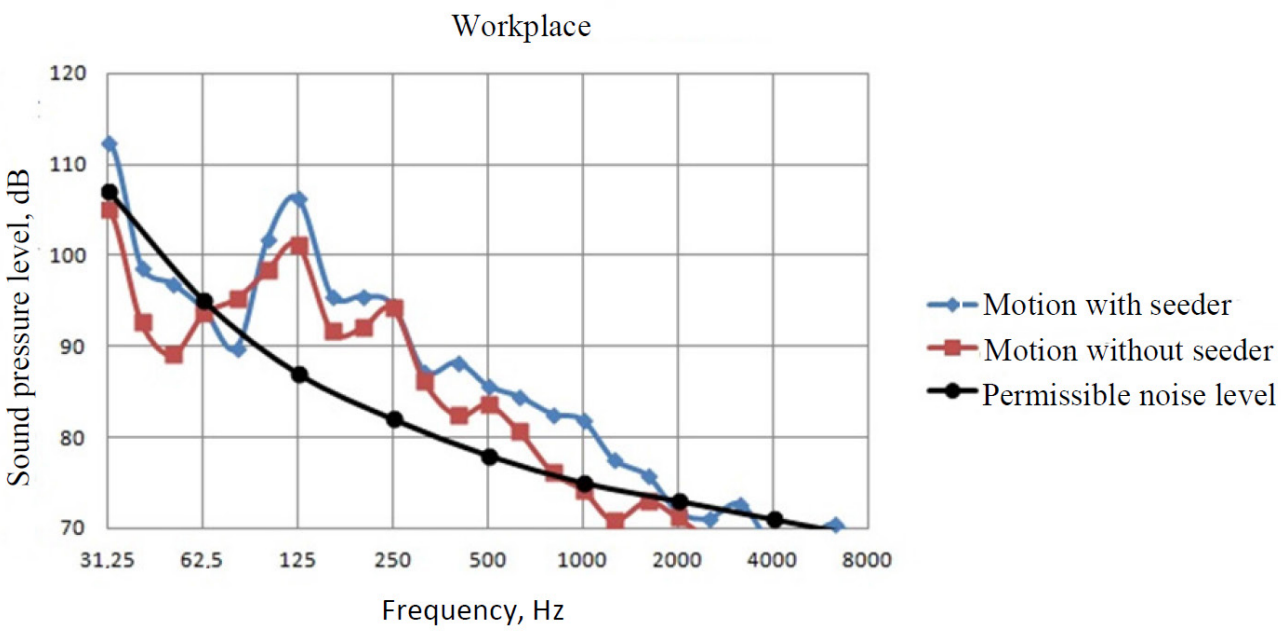

Fig. 1. Noise levels on workspace

Figure 1 shows that noise spectre maximal components are related frequencies bands with centre frequencies 31.5 and 125 Hz. Noise forming in band with centre frequency 31.5 Hz is related to vibration energy transfer from engine to cabin through frame, and as result, origin of sound vibration of cabin panels. Noise in band with centre frequency 125 Hz is caused by disturbances from 8-cylinder engine crankshaft rotation irregularities. At large noise levels measured on workspace does not corresponds to sanitary norms.

Sound pressure spectres obtained during measurements at the distance 100-150 mm from the middle of each tested cabin panels in process of tractor with seeding aggregate motion across furrow, are presented at Fig. 2.

Noise spectres have sound pressure peaks in bands with centre frequencies 31.5, 125 and 400 Hz. In low frequencies bands noise from left windshield prevails. In high frequencies bands the highest sound pressure issue from partition between engine area and cabin.

Sound pressure spectres obtained during measurements at the distance 100-150 mm from the middle of each tested cabin panels in process of the tractor motion on dirty road, are presented at Fig. 3.

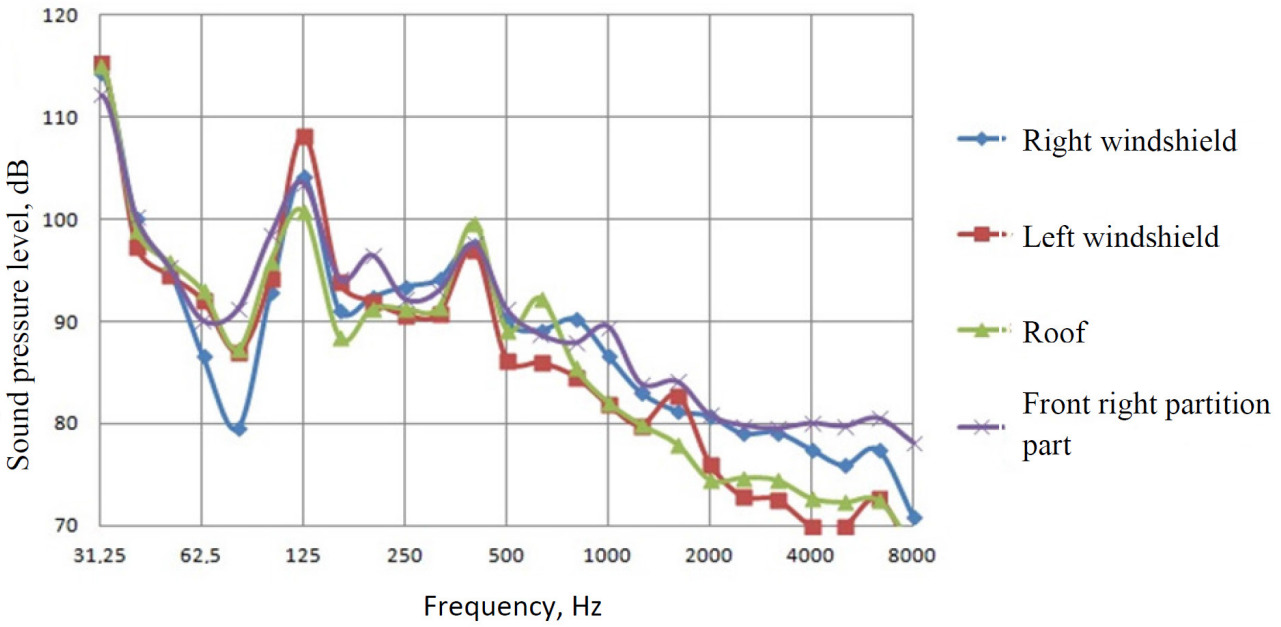

Fig.2. Noise from cabin panels during tractor with seeding aggregate motion

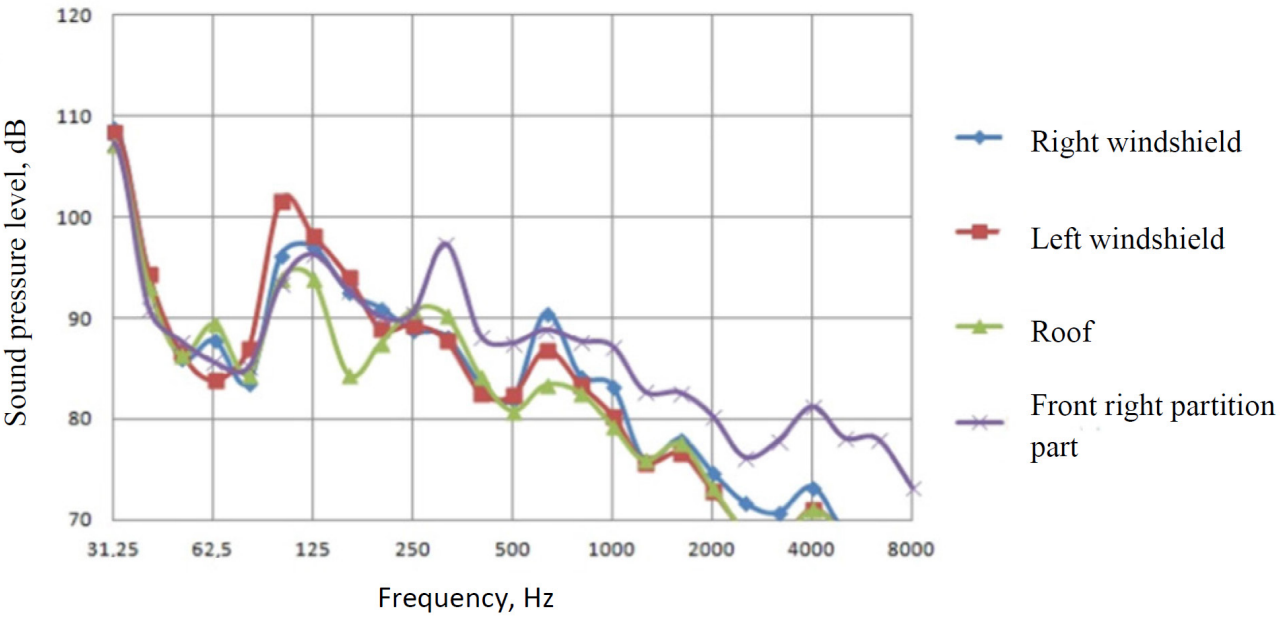

Fig.3. Noise from cabin panels during tractor without aggregate motion

At low frequencies, noise from left windshield prevails. In addition, in high frequencies bands the highest sound pressure issues from partition between engine area and cabin. Noise spectres have sound pressure peaks in bands with centre frequencies 31.5, 100...125, 300 and 600 Hz.

Total noise level perceived by operator in tractor cabin is less by 3.4 dBA during tractor motion on dirt road without aggregate than during its work with seeding machine on field prepared for winter grasp. At that, partition between engine area and cabin contributes greatly. Thus, for integrated noisiness, reducing in the tractor cabin sound isolation of partition between engine area and cabin should be increased and also sound isolation of windshields located closely to exhaust pipe has to be improved. To decrease low-frequency noise optimization of tractor cabin vibration isolation system need to be performed.

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