CROSS-FLOW OF AIR THROUGH SEALED ELEVATOR ENCLOSURES

O. A. Averkova*, I.N. Logachev* and K.I. Logachev*

* Belgorod State Technological University named after V.G. Shukhov
(BSTU named after V.G. Shukhov), 308012 Belgorod, Russia
e-mail: kilogachev@mail.ru, web page: http://www.bstu.ru

ABSTRACT

Both the direction and the flow rate of ejected air in bucket elevator [1,2] enclosures that feature a separate arrangement of carrying and idle conveyor runs would depend on the ratio between ejection heads and the difference between static pressures inside the enclosures of elevator head and elevator boot. A forward motion of air (along the bucket travel direction) arises inside the enclosure of the carrying run when ejection forces prevail and inside the return run enclosure at any ejection forces differential pressures. A counterflow of air is only possible in a single enclosure.

Relative velocities and flow rates of air inside the elevator enclosures depend on two parameters, *t* and *g*, representing the ratio of differential pressures and resistances of enclosures to ejection forces.

When pressures inside the upper and lower elevator enclosures are equal. With ejection forces large enough air velocities become equal to the velocity of traveling elevator buckets.

Absolute velocities of airflows inside enclosures are dependent not only on the velocity of moving buckets but also on the differential pressure, head resistance of elevator buckets and aerodynamic drag of enclosures, as well as spillage of particles.

In the case of a forward flow pattern, air flow rate inside the return run enclosure is greater than the one inside the carrying run enclosure of the elevator conveyor. The explanation is that ejection forces arise in an opposite direction to forces caused by differential pressure inside the carrying run enclosure (both forces act in the same direction inside the return run, thus intensifying the air ejection process and boosting additional ejection forces which occur when buckets are unloaded, producing streams of spilled particles), as well as different values of the drag coefficient for empty and laden buckets.

When air moves in a counterflow pattern, ejection forces of buckets create additional drag and therefore the absolute flow rate of ascending air inside the return run enclosure, as well as descending air inside the carrying run enclosure, increase less markedly than in the forward flow case.

REFERENCES

[1] I. N. Logachev and K.I. Logachev. *Industrial Air Quality And Ventilation: Controlling Dust Emissions*. Boca Raton: CRC Press, 2014.

[2] I. N. Logachev, K. I. Logachev and O.A. Averkova. *Local Exhaust Ventilation: Aerodynamic Processes and Calculations of Dust Emissions*. Boca Raton: CRC Press, 2015.