

## Centralized Aspiration and Cleaning of Aspiration Air of Bulk Material Supply Tracks to Converter Plant

D. V. Stalinskij, M. N. Shvec, E. G. Manjugin, A. V. Litvinenko

*SE UkrRTC "ENERGOSTAL"*

*SE UkrRTC "ENERGOSTAL"* developed and implemented complex project of reconstruction and modernization of aspiration systems for bulk material supply tracks to converter plant shop at PJSC "ArcelorMittal Kryviy Rih" with replacement of 20 local aspiration systems and dust catchers by three new centralized aspiration systems with high-performance bag filters with impulse regeneration.

**Keywords:** LOCAL AND CENTRALIZED ASPIRATION SYSTEMS, BAG FILTERS WITH IMPULSE REGENERATION OF BFIR TYPE, GAS CLEANING, MODERNIZATION AND RECONSTRUCTION, REDUCTION OF EMISSIONS

### Introduction

PJSC "ArcelorMittal Kryviy Rih" is composed of six converters – two blocks with three converters capacity 160 tons. There are tape path, including a system of conveyors, three transshipment node, charge hoppers units № 1, №2, electro-vibration feeders, weigh feeders for bulk materials in converters, from charge department. On the tape path of bulk materials have been installed and operated twenty small aspiration systems performance with outdated inefficient and low-efficient dust collectors (bag hose type SMC, cyclones, etc.). Local aspiration systems and dust collectors provided neither efficient aspiration dusting equipment, nor effective treatment of dust emissions. Efficiency of dust collectors didn't exceed 75%.

In local shelters there wasn't provided necessary exhaustion, the amount of suction air wasn't enough, which led to the deterioration of sanitary and hygienic conditions in the workplace tracts supply bulk materials. When local exhaust systems are working, it was totaling pollutants in the atmosphere such as inorganic dust containing  $\text{SiO}_2 < 20\%$  – 50.575 tons / year and the dust of coal concentrate 24.896 tons / year.

Large number of small aspiration systems with fans, dust collectors, dust extraction units, located throughout the CCC, made troubles for the staff.

UkrSSEC "Energostal" developed and realized a complex of works on the upgrading of existing inefficient aspiration systems and collection systems, including the development of complex work design,

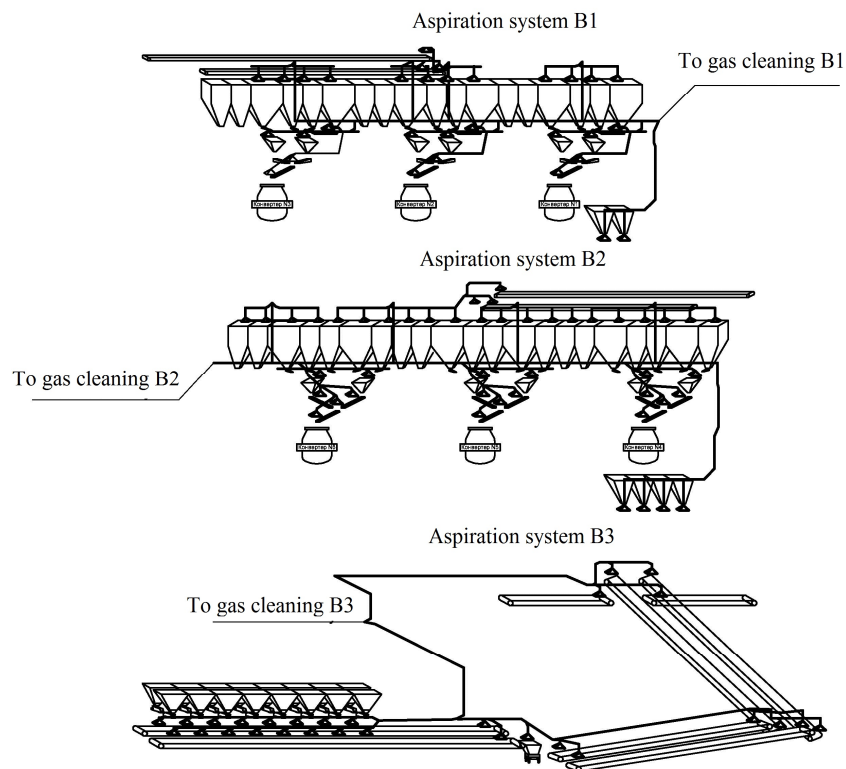
manufacture and supply of gas treatment and equipment, supervision and commissioning.

Work project provides removal of all existing local aspiration systems both dust collectors and three new device centralized aspiration systems B-1, B-2, B-3 (**Figure 1**) that combine local aspiration pumps from the feed path of bulk materials unit № 1, block № 2 and charge department of converter shop and dry cleaning of aspiration air in modern high performance bag hose filters with impulse regeneration FRIR-1100x2 and FRIR-650 design and construction are from UkrSSEC "Energostal".

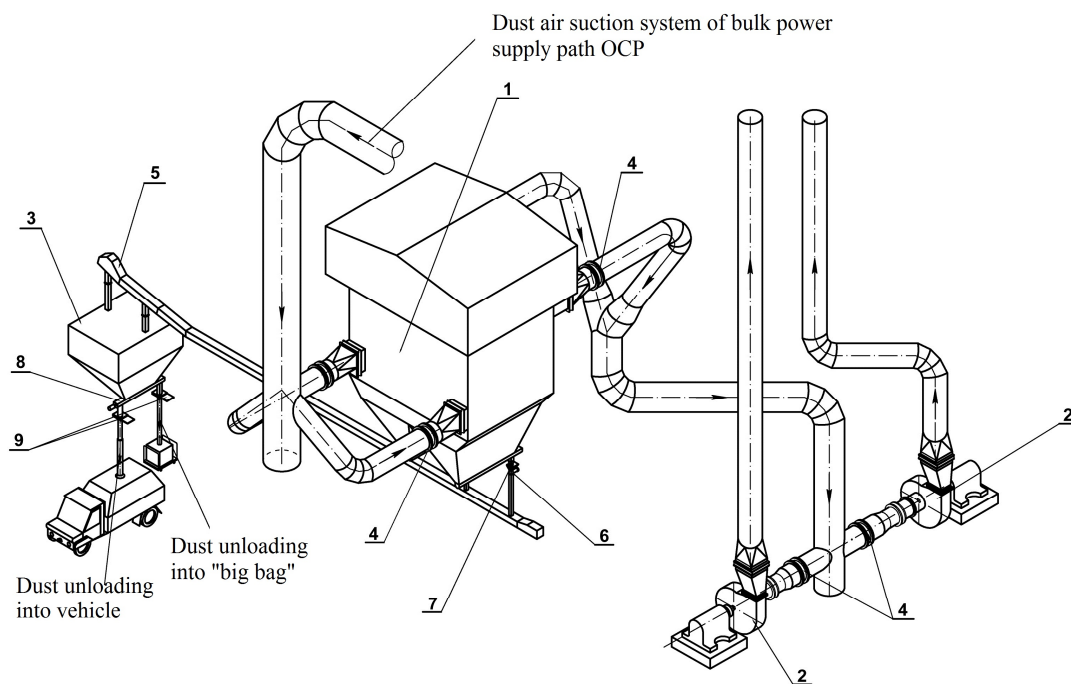
To ensure MPC dust in the working area, shops are increased by 30-40% by volume of the exhausted to the dusting equipment aspiration air in comparison with the existing situation.

As far as the shelter and aspiration hoods of local pumps are at a considerable distance from the gas treatment, there is a possibility of settling dust in the air ducts, which are based on existing building structures plant, built in 1960. To reduce the load on the existing building structures from settling dust in the air ducts, and simplicity to use (cleaning) duct systems, it was developed and implemented system of purge air by pulses of compressed air. Air purge system includes a set of electromagnetic valves and air-terminal, located in the bottom of the duct with a step 5 m, which are served by a particular algorithm impulses dry air, resulting in accumulated dust lifts and carried by air flow to gas purification.

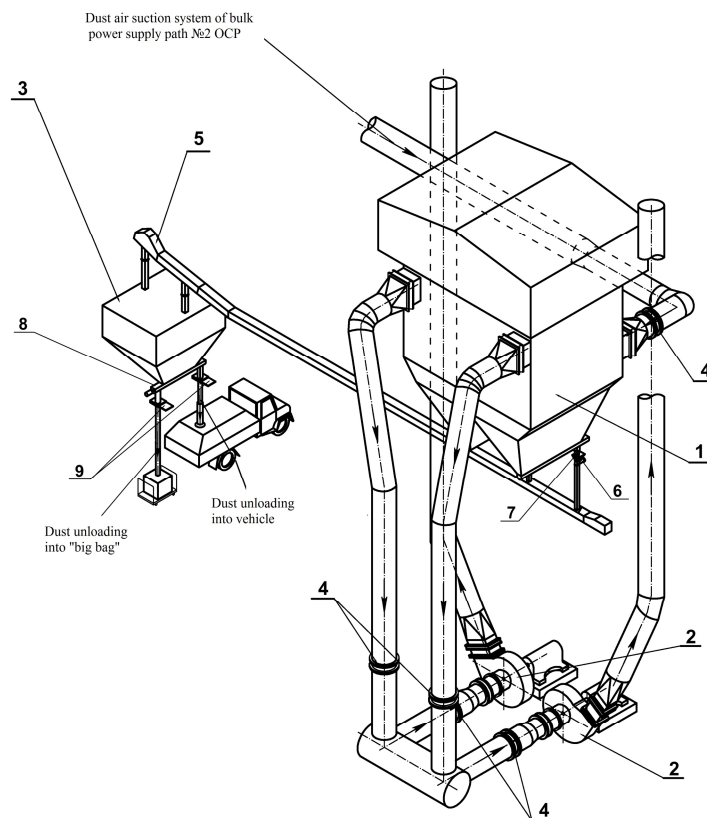
Gas cleaning aspiration system (**Figure 2, 3**) includes:



**Figure 1.** Aspiration systems B1, B2 and B3



**Figure 2.** The scheme of centralized aspiration gas purification B-1: 1 – bag hose FRIR-1100x2; 2 – exhaustor DN-19MK; 3 – dust collecting hopper; 4 – valve Du1500; 5 – conveyor COW (2 M)-320; 6 – gateway feeder; 7 – disc valve; 8 – reversing screw feeder; 9 – plate gate



**Figure 3.** The scheme of centralized aspiration gas purification B2: 1 – bag hose FRIR-1100×2; 2 – exhauster DN-19MK; 3 – dust collecting hopper; 4 – valve Du1500; 5 – conveyor COW (2 M)-320; 6 – gateway feeder; 7 – disc valve; 8 – reversing screw feeder; 9 – plate gate

- bag hose with impulse regeneration: for the B1 – FRIR 1100×2; B2 – FRIR 1100×2; B3 – FRIR-650;

- exhausters DN-19MK with electric engine  $N = 250 \text{ kW}$ ,  $n = 1000 \text{ r / min}$ ,  $U = 6 \text{ kV}$  for the B1 – 2 p., B2 – 2 p., B3 – 1 p.

- the automatic control system (ACS) for filter regeneration;

- ducts, flues, trip valves, automatic dust cleaning system with collapsible bunkers.

Bag filters with impulse regeneration type FRIR design UkrSSEC "Energostal" due to the technical level of the design meets the most famous bag hoses, specialized foreign firms and have features and advantages over other designs filters [1-3]. Bag hoses are installed in the open air with heated tents-shelters.

Bag hose regeneration system provides recovery filter ability of hose through the impulse blowing

with compressed air to demands, formed by a micro-processor controller with differential pressure (vacuum)  $\Delta P$  in a bag hose.

Unloading of captured dust from the bag hoses tank made in drag conveyors that convey the dust to a holding tank and then through the reverse screw feeder due to telescopic device discharge dust in a closed vehicle or in soft containers type "Big Bag".

Gas purification B1, B2, B3 provides the operating point, the CSP supporting rooms of maintenance staff, pantries parts and bag hoses, toilet, compressed air drying room.

Due to the tightness of the industrial area CCC and the limited gabarit for the to host gas cleaning equipment for all gas cleaning B1, B2, B3 adopted altitude arrangement.

Specifications of bag hoses gas purification B1, B2, B3 are in the **Table 1**.

**Table 1.** Specifications of bag hoses gas purification B1, B2, B3

Name	Unit	Gas purification B1 FRIR-1100×2	Gas purification B2 FRIR-1100×2	Gas purification B3 FRIR-650
Productivity on purifies aspiration air	m <sup>3</sup> /h	170840	199060	54700
Specific air load	m <sup>3</sup> /m <sup>2</sup> min	1,3	1,5	1,4
Filtration area	m <sup>2</sup>	1100×2	1100×2	650
Temperature of the cleaning dust air mixture	°C	30	30	30
The mass concentration of dust on the input of filter	g/m <sup>3</sup>	up to 3	up to 2,9	up to 3,5
Residual dust of air after filter	mg/nm <sup>3</sup>	20,0	20,0	20,0
Hydraulic resistance of the filter:				
-optimal	Pa	2000	2000	2000
-acceptable working	Pa	2500	2500	2500
Number of filter bags	unit	480×2	480×2	320
Sizes of filter bag				
-outside diameter	mm	133	133	133
-length	mm	5540	5540	5140
Number of section	unit	6×2	6×2	4
Number of bags on section	unit	80	80	80
Number of bags in one row	unit	16	16	16
The total number of gate-type valves	unit	6×2	6×2	4
Number of purge valve on one section	unit	5	5	5
The total number of purge valves	unit	30×2	30×2	20
Air pressure	MPa	0,47-0,52	0,47-0,52	0,47-0,52
Compressed air consumption in normal	nm <sup>3</sup> /h	350	350	100

On gas purification B1 bag hose and dust conveyor system are located over the railroad tracks at the converter shop, exhaust fans are located along the wall of the converter shop.

Gas purification B2 is located between the gallery feeding bulk materials and railroad highline, near to the charge department. Filter FRIR-1100×2 with dust conveyor are installed above the exhaust fans department.

Gas purification B3 is located between the building of the converter shop and railway highline. Filter FRIR-650 with the dust conveyor are installed above the exhaust fans department.

For gas purification B2 and B3, made common support facilities, as they are located close.

Centralized aspiration gas purification B1, B2, B3 are constructed, commissioned, established and provide residual dust emissions in the range of 8-19 mg/m<sup>3</sup>.

After modernization and reconstruction of aspi-

ration systems of tract supply bulk materials block №1, №2 and charge department of converter shop instead of the 20 existing dismantled emission source sit installed 3 new source:

- aspiration system of block № 1 CCC and gas cleaning B1;
- aspiration system of block № 2 CCC and gas cleaning B2;
- aspiration system of charge department, transfer node № 1, 2, 3 and gas cleaning B3.

With the total amount of purified air 462 264 m<sup>3</sup>/h with residual dust on the output of the baghoses 20 mg/m<sup>3</sup>, total emissions of dust is 2.56 g/s, which is much smaller than the current situation, reduction of total emission of dust in comparison with the existing situation is 56 tons/year.

Provided the concentration of dust in the working area, which does not exceed the maximum permissible concentration (MPC).

---

## Conclusions

Centralization of aspiration dust-separating systems of aspiration air is a modern high-performance event.

Developed and implemented UkrSSEC "Energestal" centralized aspiration systems and gas cleaning B-1, B-2, B-3 of tank of bulk materials in CCC PJSC "ArcelorMittal Krivoy Rog" is the first centralized aspiration systems in the converter industry in Ukraine, Russia and CIS countries; technical solutions of centralized systems are actual and in demand.

## References

1. *Proizvodstvo i postavka UkrGNTC "Jenergestal" sovremennyh rukavnyh fil'trov* / G. V. Viter, D. V. Stalinskij, A. Ju. Pirogov // *Jekologija i promyshlennost'*. – 2004. – № 1. – P. 36-37.
2. *Unificirovannyj rukavnyj fil'tr s impul'snoj regeneraciej tipa "FRIR" dlja suhogo obespylivanija tehnologicheskij i aspiracionnyh gazovyh vybrosov* / A. V. Erohin, G. V. Viter, A. N. Podoljaka i dr. // *Metallurg. i gornorud. prom-st'*. – 1998. – № 2. – P. 130-132.

3. *Primenenie rukavnyh fil'trov dlja ochistki aspiracionnyh vybrosov na koksohimicheskijh predpriyatijah* / M. N. Shvec, T. F. Trembach, D. V. Stalinskij, A. Ju. Pirogov // *Jekologija i promyshlennost'*. – 2006. – № 1. – P. 8-11.

## Централизованная аспирация и очистка аспирационного воздуха трактов подачи сыпучих материалов в конвертерном цехе

Сталинский Д. В., Швец М. Н.,  
Манюгин Е. Г., Литвиненко А. В.

УкрГНТЦ "Энергосталь" разработал и реализовал комплексный проект реконструкции и модернизации аспирационных систем трактов подачи сыпучих материалов в кислородно-конвертерном цехе (ККЦ) ПАО "АрселорМиттал Кривой Рог" ("АМКР") с заменой 20 локальных аспирационных систем и пылеуловителей тремя новыми централизованными аспирационными системами с высокоэффективными рукавными фильтрами с импульсной регенерацией.