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Research Article

# EXPERIMENTAL DETERMINATION OF HYDRAULIC RESIDENCE

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## Abstract

In the article modes for determining the hydrodynamic resistances of the wet dust collector and gas purifier operating in the mode in which the contact element generates a rotating flow are recommended

## Keywords

Wet method, rotational flow, contact element, interface, angle of attack, air flow, gas flow, gas velocity.

## Introduction

Dust and toxic gases from technological processes are increasing the pollution of the environment. Therefore, the only way is to protect the environment and find solutions to industrial problems. There are several types of dust and toxic gases emitted from manufacturing plants,

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and the unfortunate one is the presence of toxic substances among them that have toxic properties. At present, production facilities use devices of various structures to clean dust and toxic gases. One of the most effective ways to treat dust and toxic gases is wet cleaning, which uses several designs of this type of equipment. Various contact elements are used to humidify the dusty gases in the devices used. However, the consumption of the device, hydrodynamic resistance, and low efficiency of dust removal from the formed sludge do not allow optimal use of the device. The efficiency of this type of device is only 76 ÷ 90%.[1,2]. In order to solve these problems, we conducted experimental studies to determine the coefficient of resistance in the apparatus through the flow of liquids and gases in the apparatus, which designed and developed the contact element fluctuating current [3,4]. The contact element is in a current-generating apparatusthe following required equipment and apparatus were selected as the experimental model in determining gas velocity, flow, flow regime, and local resistance coefficients.

Centrifugal fan; working capacity $Q_{max}$ = 400 $m^3$/hour; Electromotive force $N_{eng}$ = 1.5 kW; number of revolutions n = 1200 r/min; Pito prandl tube 100 mm in size; The pipe has 2 prandl tubes with an inner diameter of 7 mm, which determine the static and dynamic forces; Anemometer VA06-TROTEC (Measuring range 1.1) to determine the velocity of dusty air supplied to the experimental model-30 m/s the error coefficient is 0.2%, when the gas velocity exceeds 30 m/s the error coefficient is up to 5%) branded digital screen electronic meter; metal pipe with gas flow rate D = 100 mm, L = 1000 mm.

One of the main parameters that determine the stable operation of dust gas cleaning is its hydraulic resistance.Therefore, in determining the velocity of the gas, a suction tube with an angle of 00, 30o, 45o, 60o, 90o was installed in the suction pipe of the fan. The main reason for this is to determine the coefficients of hydraulic resistance of the apparatus at different velocities of the gas, and thus to conduct experimental studies.

Each experiment was performed 5 times and the arithmetic mean value of the detected quantities was selected. (The kinematic viscosity of the air was assumed to be $1.51 \cdot 10^{-5}$ $m^2$/s). In the experimental determination of the gas velocity, each experiment was repeated five times, and the square dimensions of each point and the resulting errors were determined. $30^o$, $45^o$, $60^o$, which generates a flow of dusty gas into the apparatuscontact elements (zavixritel) were set up, and experimental studies were carried out by means of gas velocities through each of them.

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**Figure 1. General view of the experimental apparatus.**

## RESULTS

In the experimental determination of the gas velocity, each experiment was repeated five times, and the square dimensions of each point and the resulting errors were determined. 30°, 45°, 60°, which generates a flow of dusty gas into the apparatuscontact elements (zavixritel) were set up, and experimental studies were carried out by means of gas velocities through each of them. Hardware 30° contact element (zavixritel) is installed gas inlet speed υ = 7.07÷28.37 m/s output speed up υ = 3.2÷11.03 m/s; in apparatus 45° contact element (zavixritel) is installed gas inlet speed υ = 7.07÷28.37 m/soutput speed up υ = 3.68÷12.3 m/s and hardware 60° contact element (zavixritel) is installed gas inlet speed υ = 7.07÷28.37 m/s while the output speed is up υ = 3.85÷13.1 m/swas determined by experimental studies. Using the experimental studies, the total resistance coefficients of the apparatus were determined. Table 1 below shows the coefficients of resistance through the gas velocities at the inlet and outlet supplied to the apparatus.

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**Table 1. Coefficients of resistance through the gas velocities at the inlet and outlet supplied to the apparatus**

| № | At the entrance to the apparatus υ, m/s | Total resistance coefficient | At the exit of the device υ, m/s |
|---|---|---|---|
| When the apparatus is not watered 30° contact element (zavixritel) in the set position | | | |
| υ1 ShEBER 90° | 28.37 | 2.2 | 11.03 |
| υ2 ShEBER 60° | 24.32 | | 10.27 |
| υ3 ShEBER 45° | 22.48 | | 9.90 |
| υ4 ShEBER 30° | 15.45 | | 8.34 |
| υ5 ShEBER 0° | 7.07 | | 3.2 |
| When the apparatus is not watered 45° contact element (zavixritel) in the set position | | | |
| υ1 ShEBER 90° | 28.37 | 2 | 12.3 |
| υ2 ShEBER 60° | 24.32 | | 11.19 |
| υ3 ShEBER 45° | 22.48 | | 10.6 |
| υ4 ShEBER 30° | 15.45 | | 8.06 |
| υ5 ShEBER 0° | 7.07 | | 3.68 |
| When the apparatus is not watered 60° contact element (zavixritel) in the set position | | | |
| υ1 ShEBER 90° | 28.37 | 1.8 | 13.1 |
| υ2 ShEBER 60° | 24.32 | | 12.2 |
| υ3 ShEBER 45° | 22.48 | | 11.3 |
| υ4 ShEBER 30° | 15.45 | | 9.1 |
| υ5 ShEBER 0° | 7.07 | | 3.85 |

The hardware in Figure 1 below when not irrigated 30°, 45° and 60° contact elements a graph of the pressure change depending on the gas velocity is given.

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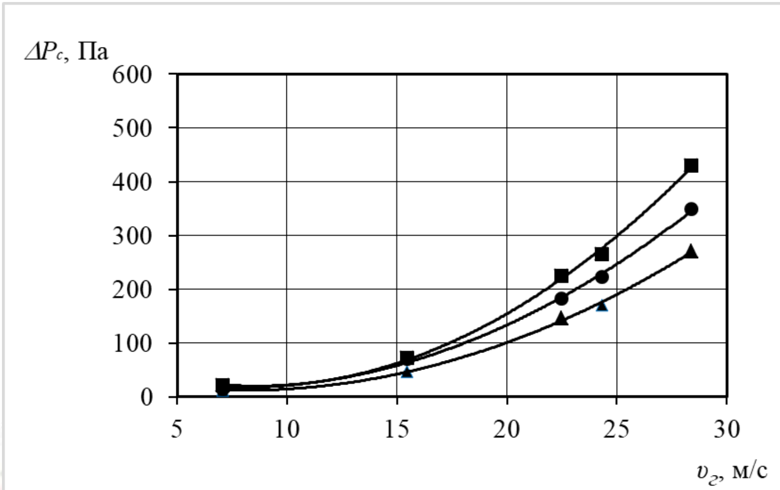


**Figure 2. Hardwarein the non-irrigated state 30°, 45° and 60° contact elements (zavixritel)a graph of the pressure change depending on the gas velocity is given.**

The average change in gas velocity per indicator increased by a step of 4.2 m/s. Built-in hardware 30°, 45° and 60° contact elements (the following hydraulic resistances in the apparatus were determined by the velocities of the gas supplied by the zavichritel). Hardware 30⁰ contact element when hydraulic resistance $\xi_1$= 2.2; 450contact elementwhenhydraulic resistance $\xi_1$= 2; 60o contact elementwhenwhile the hydraulic resistance $\xi_1$= 1.8 was found to be Figure 2 below shows a graph of hydraulic resistance based on experimental results.

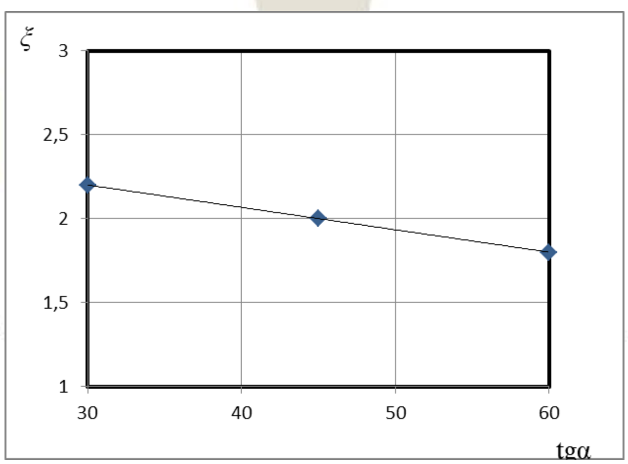


**Figure 3. Based on the results obtainedapparatuswhen not irrigated 30⁰ 45⁰ hydraulic resistance graph is given when there are 60⁰ contact elements.**

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## Conclusion

The experimental results obtained show that it is mounted on the apparatus 30$^o$, 45$^o$ and 60$^o$ contact elements (zavixritel) the hydraulic resistances of the apparatus were determined.In this case, the angle-forming shiber,contact elementsthrough and using the correlation of the resistance coefficient, the suitability of the apparatus for the purpose of selecting the optimal gas velocity based on the overall size and gas velocity was determined experimentally.

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