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Ключевые слова: ; ; ;

() (,) (, ,)
,
(. 1).

[2],

R
 r_0
 h
 $b = (R - r_0)$

$v_0 \cdot z$,

) [4].

v_z

z ,

« »

1. z :

$$v_z = \frac{v_0(R - r_0)^2}{\pi(R^2 - r^2)_0} \quad (1)$$

2.

r
[4].

u_ε

$$u_\varepsilon = u_\varepsilon(r)$$

[2,5,6]:

$$u_\varepsilon = \frac{u_0 r_0}{r}, \quad (2)$$

u_0 –

u_ε

$$v_\varepsilon(R - r) = \int_{r_0}^R \frac{u_\varepsilon^0 r_0}{r} dr = u_\varepsilon^0 r_0 \ln \frac{R}{r_0}. \quad (3)$$

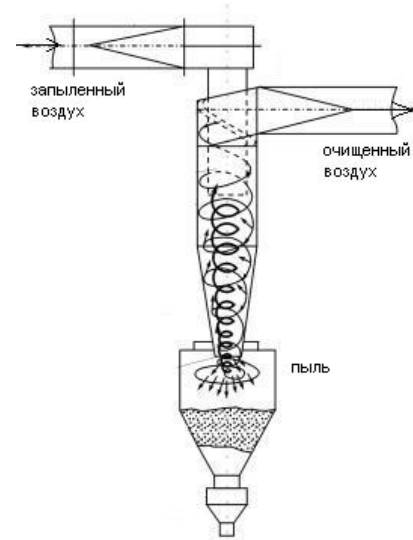


Рисунок 1. Противоточный циклон с тангенциальным локальным подводом воздуха [1]

$$v_z = v_0, \quad z$$

[7,8].

$$u'_r, \quad w_{\text{цб}}, \quad u_r, \quad z \quad [9],$$

$$w_{\text{цб}} = w \frac{(u_\varepsilon(r))^2}{gr}, \quad [3,9,10];$$

w -
g -

$$w_{\text{цб}} < u'_r,$$

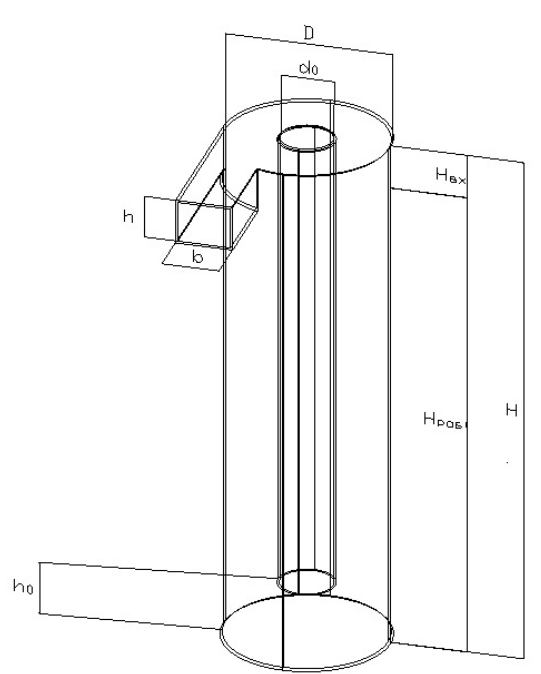


Рисунок 2. Схема циклона с подсоединением входного патрубка под углом 90°

$H_{\text{вх}}$, $H_{\text{роб}}$, H , h_0 , $H_{\text{вх}}$, $H_{\text{роб}}$, h_0 , $k - \varepsilon$, u_ε , Flow 3D.

(. 3).

« . 4) [11].

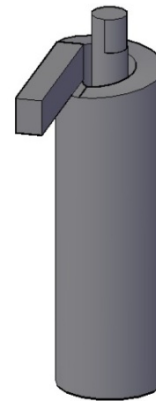
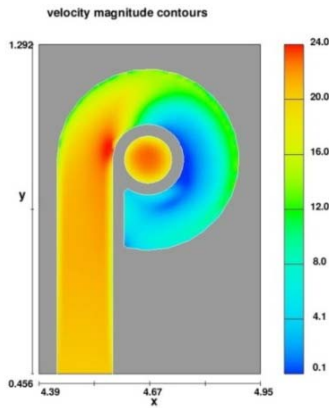


Рисунок 3. Образование водоворотных областей во входной части циклона (выделены синим цветом)

Рисунок 4. Схема циклона с подсоединением входного с «направляющей крышкой»

(. 1).

Таблица 1. Расчет потока в циклоне

№ изм	$\frac{r_0}{R}$	$\frac{b}{h}$	$\frac{H_{ex}}{d_0}$	Подсоединение входного патрубка	$\frac{a}{d_0}$	$\frac{H}{H_0}$	Коническая часть
1	0,3	>1	1,6	90°	1	1	-
2	0,4	1	1,6	90°	1	1	-
3	0,5	<1	1,6	90°	1	1	-
4	0,4	1	0	« . 4) [11].	1	1	-
5	0,4	1	1,6	90°	3	1	-
6	0,4	1	1,6	90°	1	1	+
7	0,4	1	1,6	90°	1	2	-

1. H_{ex} (. 2),

() , $H_{ex} = 3,2r_0$.

2. u_ε , r ,

(. 2).

3. v_ε ,

$v_\varepsilon = 0,6v_0$ $v_\varepsilon = 0,25v_0$ (. 2).

4. 7-10% u_ε ,

r (. 2).

5.

6. (. 2),

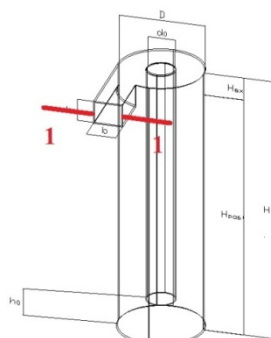
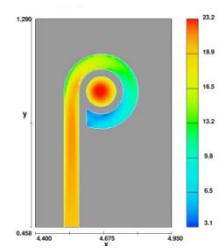
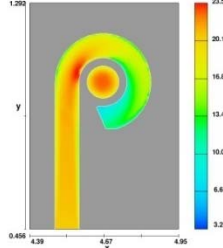
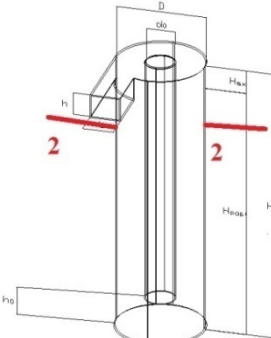
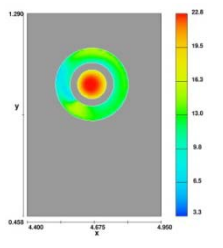
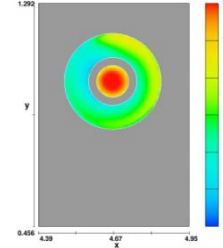
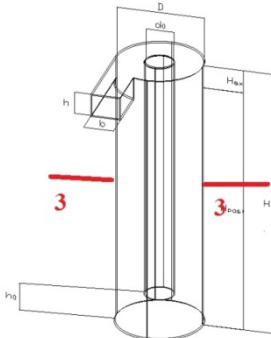
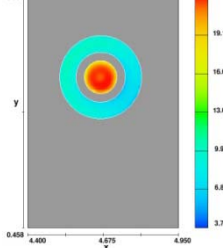
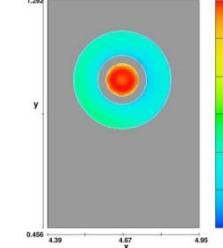
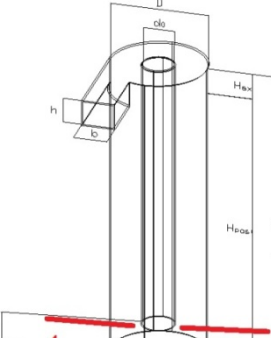
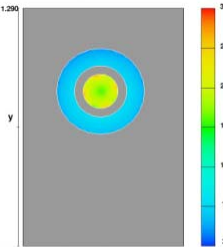
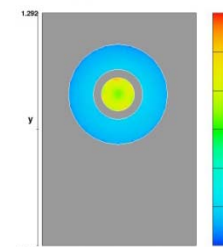
(. 2).

3,

v_ε z .
(x)

$$v_{\varepsilon} (\dots) \dots \dots \dots (4)$$

Таблица 2. Поле осредненной тангенциальной скорости по высоте циклона, значения средней тангенциальной скорости по высоте циклона

		Подсоединение входного патрубка и крышки: под углом 90°	Подсоединение входного патрубка и крышки: «направляющая крышка»
№ сечения по высоте циклона		u_{ε} $v_{\varepsilon 0} = 20 \text{ м/с}$	u_{ε} $v_{\varepsilon 0} = 20 \text{ м/с}$
1		 $v_{\varepsilon 1} = 13,2 \text{ м/с}$	 $v_{\varepsilon 4} = 18 \text{ м/с}$
2		 $v_{\varepsilon 2} = 13 \text{ м/с}$	 $v_{\varepsilon 4} = 14 \text{ м/с}$
3		 $v_{\varepsilon 3} = 8 \text{ м/с}$	 $v_{\varepsilon 4} = 7,8 \text{ м/с}$
4		 $v_{\varepsilon 4} = 4 \text{ м/с}$	 $v_{\varepsilon 4} = 4 \text{ м/с}$

«...»

... [12,13].

... [14].

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Numerical modelling the three-dimensional velocity field in the cyclone

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Key words

cyclone; free-falling velocity; tangential velocity; distribution of velocity; axial velocity

Abstract

The urgency of work is determined by the importance of developing methods for calculating cyclones and improving their design, due to popular usage cyclones for air cleaning.

The efficiency of dust cleaning depends on the velocity distribution in the body of cyclone. Researches of the distribution of tangential velocity and turbulent velocity on the basis of physical modeling of air flow in the body of the cyclone is associated with large, sometimes technically insurmountable difficulties (essentially three-dimensional movement of air, a complex configuration limits the flow, etc.). Therefore, mathematical modeling of turbulent gas flow in the cyclone was made.

Mathematical modeling provided data on the distribution of velocity in the cyclone. Most important result is that the tangential flow of air entering the cyclone, expands in the axial direction, which leads to lower efficiency extraction. To eliminate this effect the design of the cyclones should be improved.

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