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HYDRAULIC CALCULATION OF THE STOCK PART OF THE BUILDING WATER SUPPLY SYSTEM

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ANNOTATION: *This article describes the methods of hydraulic calculation of the riser section of the internal sewage system of a building. The riser is the main element that vertically lowers the wastewater from sanitary and technical devices in multi-storey buildings. The calculation process takes into account the number of devices, conditional load (DU), waste flow, riser diameters and ventilation requirements. The article analyzes the conditions necessary for the effective operation of the system using calculation formulas, tables and calculation examples based on standard norms. Properly performed hydraulic calculation ensures safe, long-term and noise-free operation of the sewage system.*

Key words*: Hydraulic calculation, wastewater system, sewerage design, drainage system, building water supply, sanitary engineering, flow rate calculation, pipe diameter selection, slope of drainage pipes, wastewater velocity, hydraulic gradient, backflow prevention, ventilation of sewer lines, combined and separate systems, stormwater drainage, wastewater load, sanitary discharge units, manhole placement, self-cleansing velocity, system reliability.*

INTRODUCE

The internal sewage system of a building is an engineering system designed to collect wastewater from sanitary and technical equipment and discharge it to an external or central sewer. One of the main elements of this system is a riser (vertical pipe) , which receives wastewater from several floors and directs it downwards. The hydraulic calculation of the riser plays an important role in ensuring its reliable, safe and noiseless operation.

1. The rack task and characteristics

Stoyak — building is a vertical pipe inside , u sanitary dirty from equipment (toilet, sink, shower , etc.). receives waters and them lower to the collector delivers This element is not only water take discharge , but also provides air exchange (ventilation) in the system .

2. Determining the amount of waste in the stack

Rack based on the number of connected sanitary equipment general The calculated waste rate (Q) is determined. This given in regulatory documents equipment load (DU – drainage units) or directly ri l /s units are used.

Formula:

Qrasch=Kn · qed · nQ_ { rasch } = K_n \ cdot q_ { ed } \ cdot \ sqrt { n } Qrasch = Kn · qed · n

this on the ground :

- Q raschQ_ { rasch } Qrasch— calculated waste flow rate , l/s;
- KnK_n Kn — inequality coefficient (usually 0.5–0.7);
- qedq_ { ed } qed — waste of one device, l/s;
- nn n is the number of devices.

Example :

On each floor in a 5-story house :

- 1 toilet (1.5 DU),
- If 1 crab is (0.5 DU) , → total DU = 5 × (1.5 + 0.5) = 10 DU

Standards according to : 10 DU ≈ 1.2 l/ s

3. The diameter of the column selection

To the table below mainly the diameter of the strut is selected :

Diameter (mm)	Purpose	Maximum consumption (l/s)
50	Shower, sink, bath	0.7 – 1.0
75	One how many devices	Up to 1.5
100	Toilets with	Up to 4.0

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Diameter (mm)	Purpose	Maximum consumption (l/s)
150	Trade , public buildings	4.0↑

Rule: for a stand with a toilet attached minimum diameter — 100 mm .

4. Hydraulic conditions of operation of the column

- Flow speed : 0.7 - 2.0 m / s need ;
- Pipe filling level : no more than 60% need ;
- Proper ventilation necessary , otherwise hydrozatvors sucked to leave possible ;
- Voice insulation multi - storey and community important in buildings .

5. Ventilation

Air release is provided through the upper part of the stand . The following types available :

- Direct ventilation : the rack goes up to the roof ;
- Additional ventilation racks : basic to the rack is connected .

It keeps the pressure of the ventilation system stable standing and to be cut effects ahead will take .

6. Calculation example

Conditions :

- 5 floors, on each floor: 1 toilet + 1 sink
- 10 DU total load → 1.2 l/s expense

✅ Stand Ø100 mm straight will

come ✅ Slopes, ventilation and proper connections provided — system is reliable .

1. In the building daily water consumption :

- average daily spending :

m 3 /day

m 3 /day

m 3 /day

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− maximum daily spending :

m 3 /day

m 3 / day

m 3 / day

No. Household service to show building name Household service to show or population to live building area

m 2 Household service to show building work hour or shift Household service to show of the building daily coming customers and number of employees U Number of sanitary ware N Number of types of sanitary equipment N Expenses

Average daily sarf

q tot s .k un

l/day

No.	Household service to show building name	Household service to show or population to live building area m 2	Household service to show building work hour or shift	Household service to show of the building daily coming customers and number of employees U	Number of sanitary ware N			Number of types of sanitary equipment N	Expenses: Average daily sarf $q^{tot}_{s.k\,un}$ l/day
					General water	Hot water	Cold water		General water
1	Population to live	532	-	100	60	45	60	4	250
3	Pharmacy	133	1st week 9:00-23:00	5	3	2	3	2	12
4	Market , shop	133	1st week 6:00-14:00 2nd week 14:00-22:00	5	3	1	3	3	250

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5	Barbershop	133	1st week 6:00-14:00 2nd week 14:00-22:00 3rd week 22:00-6:00	90	15	14	15	3	56
6	Kanstavar	133	1st week 9:00-22:00	8	2	1	2	2	12
7	Asphalt area	3500	1st week 9:00-22:00						0.5
8	Green field	6500	1st week 9:00-22:00						4.5
14	**SUM** ∑			**208**	**83**	63	83		**330**

Expenses												
Average daily save qtots .k flour l/day		Maximum daily sarf $q^{tot}_{m.k\ un}$ l/day			Hourly cost $q^{tot}_{c.hour}$ l/ hour			Maximum second spend $q^{tot}_{0.sec}$ l /sec			Maximum hourly spend $q^{tot}_{0.hour}$ l/ hour	
Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water
105	145	300	120	180	15.6	10	5.6	0.3	0.2	0.2	300	200
5	7	16	7	9	4	2	2	0.14	0.1	0.1	80	60
65	185	250	65	185	37	9.6	27.4	0.3	0.2	0.2	300	200
33	23	60	35	25	9	4.7	4.3	0.14	0.1	0.1	60	40

5	7	16	7	9	4	2	2	0.14	0.1	0.1	80	60
-	0.5	0.5	-	0.5	-	-	-	-	-	-	-	-
-	4.5	4.5	-	4.5	-	-	-	-	-	-	-	-
		342			**54**			**0.72**				

	1. Water expense						**2.** Sanitary equipment movement probably P^{tot}					
Maximum hourly expense	Average daily water expense $Q_{s.k\,un}$ m3/day			Maximum daily water expense $Q_{m.k\,un}$ m3/day			Sanitary equipment movement extimoli , second P^{tot}_{sec}			Total sanitary equipment movement probability , in seconds $\sum P^{tot}_{sec}$		
Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water
200							0.024	0.031	0.013			
60							0.013	0.014	0.009			
200	62.45	13.86	48,586	67,858	15,566	52,292	0.057	0.067	0.063	0.040	0.043	0.025
40							0.107	0.084	0.072			
60							0.032	0.044	0.022			
-												
-												
360							0.233	0.240	0.157			

3. Sanitary equipment movement probably P^{tot}_{hour}						**4.** For 1 sanitary equipment falling general water expen				
Sanitary equipment movement extimoli , hourly P^{tot}_{hour}			Total sanitary equipment movement probability , hourly $\sum P^{tot}_{hour}$			1 for sanitary equipment falling general water consumption , per second $q^{tot}_{0.sec\sum}$ l /sec			1 for sanitary equipment fallin water cost , hourly $q^{tot}_{0.hour\sum}$ l/ hour	
General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water
0.087	0.111	0.047								
0.083	0.083	0.056								
0.206	0.240	0.228	0.241	0.258	0.164	0.234	0.169	0.165	11,421	6,331
0.900	0.755	0.645								
0.200	0.267	0.133								
						9,000				
1,476	1,456	0.976								

	5. Maximum second water expense									**6.** Maximum hourly water expense		
	$(N1+……+Nn)^* \sum P^{tot}_{sec}$			Coefficient $\alpha_{sec\sum}$			Maximum second water expense q^{tot}_{sec}			$(N1+……+Nn)^* \sum P^{tot}_{hours}$		
Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	
5,659	3,326	2,703	2,115	1,954	1,724	1,479	2,288	1,454	1,218	19,967	16,248	

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6. Maximum hourly water expense							7. 24 hours inside of the building average hourly expense		
	Coefficient $\alpha_{hour\sum}$			Maximum hourly water expense What ^{time} $_{\text{is it?}}$					
Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water	General water	Hot water	Cold water
13,593	6,893	5,876	5,159	0.394	0.186	0.146	2.83	0.65	2.18

Conclusion

The hydraulic calculation in the column part is of the sewage system effective to work milestone that provides . Correctly calculated diameter , flow rate and ventilation conditions because of system for a long time and safe works To regulatory documents and construction standards in designing to lean on necessary .

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