

## MECHANICAL SYSTEM CALCULATION

### WATER SUPPLY SYSTEM

Supply flow calculations are made based on the calculation flows of sanitary equipment as shown below:

Unit of measure

l/h

User type

Offices and similar

Suggested simultaneous-use factor

Appliances	Number of appliances	Single flow rate	Flow rate
Kitchen sink		720 l/h	0 l/h
Wash basin	2	360 l/h	720 l/h
Bidet		360 l/h	0 l/h
Shower		540 l/h	0 l/h
Bathtub		720 l/h	0 l/h
WC with cistern		360 l/h	0 l/h
Washing machine		360 l/h	0 l/h
Dishwasher		720 l/h	0 l/h
Other		0 l/h	0 l/h
Total flow rate			720 l/h
Design flow rate			690 l/h

OK

Depending on the flow calculated in the table above, we select the dimensions of the sink water supply pipes in particular and their main supply line

### Perdite di carico continue TUBI IN PEX - Temperatura acqua = 10°C

<i>r</i> = perdite di carico continue, mm c.a./m														<i>G</i> = portate, l/h		<i>v</i> = velocità, m/s	
<i>r</i>	Øe	12	15	18	20-22	28	32	40	50	63	75	90	110	Øe			
	Øi	8	10	13	16	20	26	32,6	40,8	51,4	61,2	73,6	90	Øi			
2	G	12	22	45	79	146	297	548	1.008	1.887	3.031	5.001	8.633	G	2		
	v	0,07	0,08	0,09	0,11	0,13	0,16	0,18	0,21	0,25	0,29	0,33	0,38	v			
4	G	18	33	67	118	216	441	815	1.498	2.804	4.504	7.431	12.828	G	4		
	v	0,10	0,12	0,14	0,16	0,19	0,23	0,27	0,32	0,38	0,43	0,49	0,56	v			
6	G	23	42	85	149	273	556	1.027	1.889	3.536	5.678	9.368	16.173	G	6		
	v	0,13	0,15	0,18	0,21	0,24	0,29	0,34	0,40	0,47	0,54	0,61	0,71	v			
8	G	27	49	100	175	322	655	1.211	2.226	4.167	6.692	11.042	19.063	G	8		
	v	0,15	0,17	0,21	0,24	0,28	0,34	0,40	0,47	0,56	0,63	0,72	0,83	v			
10	G	30	56	113	199	365	744	1.376	2.529	4.734	7.602	12.544	21.655	G	10		
	v	0,17	0,20	0,24	0,28	0,32	0,39	0,46	0,54	0,63	0,72	0,82	0,95	v			
12	G	34	62	126	221	405	826	1.527	2.807	5.254	8.437	13.921	24.033	G	12		
	v	0,19	0,22	0,26	0,31	0,36	0,43	0,51	0,60	0,70	0,80	0,91	1,05	v			
14	G	37	67	137	242	443	902	1.667	3.065	5.738	9.214	15.203	26.246	G	14		
	v	0,20	0,24	0,29	0,33	0,39	0,47	0,55	0,65	0,77	0,87	0,99	1,15	v			
16	G	40	73	148	261	478	974	1.799	3.308	6.193	9.945	16.409	28.327	G	16		
	v	0,22	0,26	0,31	0,36	0,42	0,51	0,60	0,70	0,83	0,94	1,07	1,24	v			
18	G	42	78	159	279	511	1.042	1.925	3.539	6.624	10.637	17.551	30.299	G	18		
	v	0,23	0,28	0,33	0,39	0,45	0,54	0,64	0,75	0,89	1,00	1,15	1,32	v			
20	G	45	83	169	296	543	1.106	2.044	3.758	7.035	11.297	18.640	32.180	G	20		
	v	0,25	0,29	0,35	0,41	0,48	0,58	0,68	0,80	0,94	1,07	1,22	1,41	v			
22	G	48	87	178	313	573	1.168	2.159	3.969	7.429	11.929	19.683	33.981	G	22		
	v	0,26	0,31	0,37	0,43	0,51	0,61	0,72	0,84	0,99	1,13	1,29	1,48	v			
24	G	50	92	187	329	602	1.228	2.269	4.171	7.807	12.537	20.687	35.713	G	24		
	v	0,28	0,32	0,39	0,45	0,53	0,64	0,75	0,89	1,05	1,18	1,35	1,56	v			
26	G	52	96	196	344	631	1.285	2.375	4.366	8.173	13.124	21.655	37.384	G	26		
	v	0,29	0,34	0,41	0,48	0,56	0,67	0,79	0,93	1,09	1,24	1,41	1,63	v			
28	G	55	100	204	359	658	1.341	2.478	4.555	8.526	13.692	22.592	39.002	G	28		
	v	0,30	0,35	0,43	0,50	0,58	0,70	0,82	0,97	1,14	1,29	1,48	1,70	v			
30	G	57	104	213	373	684	1.395	2.577	4.738	8.869	14.242	23.500	40.570	G	30		
	v	0,31	0,37	0,44	0,52	0,60	0,73	0,86	1,01	1,19	1,34	1,53	1,77	v			
35	G	62	114	232	408	747	1.523	2.814	5.175	9.686	15.554	25.664	44.306	G	35		
	v	0,34	0,40	0,49	0,56	0,66	0,80	0,94	1,10	1,30	1,47	1,68	1,93	v			
40	G	67	123	250	440	806	1.644	3.038	5.585	10.454	16.787	27.699	47.819	G	40		
	v	0,37	0,43	0,52	0,61	0,71	0,86	1,01	1,19	1,40	1,59	1,81	2,09	v			
45	G	72	131	268	471	863	1.758	3.249	5.974	11.181	17.956	29.628	51.148	G	45		
	v	0,40	0,46	0,56	0,65	0,76	0,92	1,08	1,27	1,50	1,70	1,93	2,23	v			
50	G	76	140	285	500	916	1.867	3.451	6.344	11.875	19.070	31.466	54.322	G	50		
	v	0,42	0,49	0,60	0,69	0,81	0,98	1,15	1,35	1,59	1,80	2,05	2,37	v			
60	G	85	155	316	555	1.017	2.072	3.830	7.041	13.179	21.164	34.921	60.287	G	60		
	v	0,47	0,55	0,66	0,77	0,90	1,08	1,27	1,50	1,76	2,00	2,28	2,63	v			
70	G	92	169	345	606	1.110	2.263	4.182	7.689	14.393	23.113	38.137	65.838	G	70		
	v	0,51	0,60	0,72	0,84	0,98	1,18	1,39	1,63	1,93	2,18	2,49	2,87	v			
80	G	100	183	372	654	1.198	2.443	4.514	8.299	15.534	24.946	41.161	71.058	G	80		
	v	0,55	0,65	0,78	0,90	1,06	1,28	1,50	1,76	2,08	2,36	2,69	3,10	v			
90	G	107	195	398	700	1.282	2.613	4.828	8.877	16.616	26.683	44.026	76.006	G	90		
	v	0,59	0,69	0,83	0,97	1,13	1,37	1,61	1,89	2,22	2,52	2,87	3,32	v			
100	G	113	207	423	743	1.361	2.775	5.128	9.428	17.647	28.338	46.758	80.722	G	100		
	v	0,63	0,73	0,88	1,03	1,20	1,45	1,71	2,00	2,36	2,68	3,05	3,52	v			

  

<i>Se</i> = superficie esterna, m <sup>2</sup> /m														<i>Si</i> = sezione interna, mm <sup>2</sup>		<i>V</i> = contenuto acqua, l/m	
Øe [mm]	12	15	18	20-22	28	32	40	50	63	75	90	110	Øe [mm]				
Øi [mm]	8	10	13	16	20	26	32,6	40,8	51,4	61,2	73,6	90	Øi [mm]				
<i>Se</i> [m <sup>2</sup> /m]	0,038	0,047	0,057	0,063-0,069	0,088	0,101	0,126	0,157	0,198	0,236	0,283	0,346	<i>Se</i> [m <sup>2</sup> /m]				
<i>Si</i> [mm <sup>2</sup> ]	50	79	133	201	314	531	835	1.307	2.075	2.942	4.254	6.362	<i>Si</i> [mm <sup>2</sup> ]				
<i>V</i> [l/m]	0,05	0,08	0,13	0,20	0,31	0,53	0,83	1,31	2,07	2,94	4,25	6,36	<i>V</i> [l/m]				

## WATER SUPPLY PUMP CALCULATION:

Unit of measure

m<sup>3</sup>/h

User type

Residential building

Simultaneous-use factor according to UNI EN 806

Appliances	Number of appliances	Single flow rate	Flow rate
Kitchen sink		0.72 m <sup>3</sup> /h	0 m <sup>3</sup> /h
Wash basin	2	0.36 m <sup>3</sup> /h	0.72 m <sup>3</sup> /h
Bidet		0.36 m <sup>3</sup> /h	0 m <sup>3</sup> /h
Shower		0.72 m <sup>3</sup> /h	0 m <sup>3</sup> /h
Bathtub		1.44 m <sup>3</sup> /h	0 m <sup>3</sup> /h
WC with cistern		0.36 m <sup>3</sup> /h	0 m <sup>3</sup> /h
Washing machine		0.72 m <sup>3</sup> /h	0 m <sup>3</sup> /h
Dishwasher		0.72 m <sup>3</sup> /h	0 m <sup>3</sup> /h
Other		0 m <sup>3</sup> /h	0 m <sup>3</sup> /h
Total flow rate			0.72 m <sup>3</sup> /h
Design flow rate			0.72 m <sup>3</sup> /h

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Pump prevalence calculation																																	
Ø Nominal	Ø16			Ø20			Ø25			Ø32			Ø40			Ø50			Ø63			Ø75			Ø90			Ø110			Ø125		
Loss in mm/m	1/h m/s			1/h m/s			1/h m/s			1/h m/s			1/h m/s			1/h m/s			1/h m/s			1/h m/s			1/h m/s			1/h m/s			1/h m/s		
4	39 0.1	0		70 0.1	0		130 0.2	0		253 0.2	0		463 0.23	0		870 0.28	0		1621 0.32	0		2602 0.37	0		4268 0.42	0		7376 0.48	0		12240 0.53	0	
8	57 0.2	0		104 0.2	0		194 0.3	0		377 0.3	0		697 0.35	0		1293 0.41	0		2409 0.48	0		3866 0.55	0		6342 0.62	0		10361 0.72	0		18720 0.8	0	
12	72 0.2	0		131 0.27	0		224 0.3	0		475 0.4	0		879 0.44	0		163 0.52	0		304 0.61	0		4874 0.69	0		7396 0.79	0		13819 0.91	0		23760 1.02	0	
16	85 0.3	0		155 0.3	0		288 0.4	0		560 0.4	0		1036 0.52	0		1922 0.61	0		3579 0.72	0		5745 0.81	0		9424 0.93	0		16288 1.07	0		27000 1.16	0	
20	97 0.3	0		176 0.4	0		327 0.4	0		636 0.5	0		1177 0.59	0		2183 0.69	0		4066 0.82	0		6527 0.92	0		10706 1.05	0		18503 1.21	0		30000 1.33	0	
22	102 0.3	0		186 0.4	0		346 0.4	0		671 0.5	0		1243 0.62	0		2305 0.73	0		4294 0.86	0		6892 0.98	0		11305 1.11	0		19539 1.28	0		32000 1.54	0	
24	108 0.3	0		195 0.4	0		363 0.5	0		706 0.6	0		1306 0.65	0		2423 0.77	0		4513 0.9	0		7243 1.02	0		11881 1.17	0		20535 1.35	0		34000 1.85	0	
26	113 0.4	0		204 0.4	0		380 0.5	0		739 0.6	0		1367 0.68	0		2536 0.8	0		4724 0.95	0		7582 1.07	0		12437 1.22	0		21436 1.41	0		36000 2.16	0	
28	117 0.4	0		213 0.4	0		397 0.5	0		770 0.6	0		1426 0.71	0		2646 0.84	0		4928 0.99	0		7910 1.12	0		12975 1.27	0		23000 1.47	0		38000 2.47	0	
30	122 0.4	0		222 0.5	0		413 0.5	0		801 0.6	0		1484 0.74	0		2752 0.87	0		5126 1.03	0		8223 1.16	0		13437 1.33	0		23327 1.53	0		39000 2.78	0	
35	133 0.4	0		242 0.5	0		451 0.6	0		875 0.7	0		1620 0.81	0		3006 0.95	0		5598 1.12	0		8986 1.27	0		14740 1.45	0		25475 1.67	0		42000 3.03	0	
40	144 0.5	0	10	261 0.5	400	7	486 0.6	280		945 0.7	0		1743 0.87	0		3244 1.03	0		6042 1.21	0	120	9693 1.37	###		15909 1.59	0		27495 1.8	0		45000 3.4	0	
45	154 0.5	0		273 0.6	0		520 0.7	0		1010 0.8	0		1871 0.94	0		3470 1.1	0		6463 1.3	0		10374 1.47	0		17016 1.67	0		29410 1.93	0		48000 3.71	0	
50	164 0.5	0		297 0.6	0		552 0.7	0		1073 0.8	0		1987 0.99	0		3685 1.17	0		6864 1.38	0		11018 1.56	0		18072 1.78	0		31235 2.05	0		51000 4.02	0	
60	181 0.6	0		323 0.7	0		613 0.8	0		1191 0.9	0		2205 1.1	0		4090 1.3	0		7617 1.53	0		12228 1.73	0		20057 1.97	0		35500 2.28	0		58000 4.32	0	
70	198 0.6	0		359 0.7	0		670 0.9	0		1301 1	0		2408 1.2	0		4467 1.42	0		8319 1.67	0		13353 1.89	0		21904 2.15	0		37856 2.43	0		63000 3.94	0	
Σ Loss according diameters mkH2O			0			400			280		0			0			0			0			###			0			0			0	
Σ Totale loss - m kH2O																													5.48				
Fittings	Elbow 90°		Kurbе 90°		Ti		Valve with sphere		Butterfly valve		Non return valve		3 way valve		Acumul		Indoor unit												Ekuivalen timi ac m/l				
ø16 PPR(3/8")	0.5	0	5	0.4	2		0.3	0		1.2	0		0.0	0		0.4	0		1.2	0											2.0		
ø20 PPR(1/2")	0.8	0	6	0.5	3	1	0.3	0.3	2	1.5	2.9		0.0	0	1	0.42	0.4		1.47	0											6.7		
ø25 PPR(3/4")	1	0		0.8	0		0.5	0		1.6	0		0.0	0		0.44	0		1.65	0											0.0		
ø32 PPR(1")	1.1	0		0.9	0		0.7	0		2	0		0.0	0		0.5	0		2.2	0											0.0		
ø40 PPR(1 1/4")	1.3	0		0.9	0		1	0		2.1	0		0.0	0		0.52	0		2.2	0											0.0		
ø50 PPR(1 1/2")	1.4	0		1	0		1.2	0		3.8	0		0.0	0		0.54	0		4.3	0											0.0		
ø63 PPR(2")	1.9	0		1	0		1.9	0		5	0		0.0	0		0.75	0		5.47	0											0.0		
ø75 PPR(2 1/2")	2.4	0		1.2	0		2.4	0		0	0		0.5	0		0.75	0		5.89	0											0.0		
ø90 PPR(3")	2.5	0		1.2	0		3.1	0		0	0		0.9	0		0.9	0		7.5	0											0.0		
ø110 PPR(4")	3.3	0		1.7	0		4.2	0		0	0		1.0	0		1	0		7.87	0											0.0		
ø125 PPR(5")	4.8	0		2.1	0		4.8	0		0	0		2.0	0		1.5	0		8.1	0											0.0		
Σ Total ac m/l																													8.7				
Σ Total local loss mkH2O																													0.21675				
Security coefficient																													20.00%				
Σ Total loss mkH2O																													6.8361				
Pressure loss at the most disadvantage valve mkH2O																													10				
Pump prevalence mkH2O																													16.8361				

From the calculations the results and requirements for the water supply pump are:

$Q = 0.72 \text{ m}^3/\text{h}$

$H = 17 \text{ mH}_2\text{O}$ ,

Due to the categorization of pumps, we have chosen an inverter pump with a range of flow and loss:

$H = 27 \text{ mH}_2\text{O}$

$Q = 1\text{--}3 \text{ m}^3/\text{h}$ .

We also have foreseen a pressure reducer to adjust the pressure and flow. In this way we have controlled flow and pressure.

## WASTE WATER DISCHARGE SYSTEM

Table of water flow rates for different types of sanitary equipment.

SANITARY EQUIPMENT	DU [l/s]
Sink	0.5
Bidet	0.5
Shower	0.8
Bathtub	0.8
Washbasin	0.8
WC	2.5

Simultaneity coefficient according to the type of building.

Building typology	Coefficient $K$
Home and Offices	0.5

Formula for calculating the discharge flow rate according to the type of building.

$$Q_{ww} = K \sqrt{\sum DU}$$

**PROJEKTOI : ArchiMED S.P.S.**

**DIMENSIONS OF WASTEWATER DISCHARGE PIPE**

<b>OBJECT :</b>	Durres Hammam	
<b>CLIENT :</b>	UNOPS	
<b>DATE :</b>	Aug-21	
<b>DRAWING NO :</b>	M 03-01	

Flow [l/s]	Dim. [mm]	Dim. [mm]	Q/equipment [l/s]	Equipment
[ 0 - 0.5 ]	DN 50		2.5	WC
[ 0.5 - 0.9 ]	DN 70		0.5	Bidet
[ 0.9 - 1.1 ]	DN 80		0.8	Shower
[ 1.1 - 1.2 ]	DN 90		0.5	Sink
[ 1.2 - 3 ]	DN 100		0.8	Washing machine
[ 3 - 4 ]	DN 125		0.8	Wash basin
[ 4 - 7 ]	DN 150		0.8	Drain
[ 7 - 15 ]	DN 200		0.2	Urinal
[ 15 - 20 ]	DN 225		0.8	Dishwasher
[ 20 - 27 ]	DN 250			
[ 27 - 48 ]	DN 300			

	Koef. K	Pajisja	Nr. Pajisje	Σ Prurje
Homes/Offices	0.5	WC	0	0
Hospital,school,restaurant,hotel	0.7	Bidet	0	0
Public bathriim and showers	1	Shower	0	0
Laboratories	1.2	Sink	2	1
		Washing machine	0	0
		Wash basin	0	0
		Drain		0
		Urinal		0
		Dishwasher		0
		TOTAL		1
		SQUARE		1.00

**FLOW [l/s]**

**0.50**