

Liquid jet mixers

APPLICATIONS

Liquid jet mixers are jet pumps to **mix and circulate** liquids.

The range of applications for liquid jet mixers is only limited by the viscosity of the liquid to be mixed. As a rule, jet mixers can be used in all cases where the liquid to be mixed can still be supplied by a centrifugal pump.

Liquid jet mixers are mainly used in vessels, storage tanks and neutralization basins.

CONSTRUCTION AND MODE OF OPERATION

The liquid jet coming out of the motive nozzle generates a partial vacuum in the inlet cone of the diffuser, and therefore, a liquid flow is extracted from the tank and is entrained. The motive jet mixes with the entrained liquid and accelerates its flow. The liquid mixture emerging from the jet mixer spreads out in conical form and entrains more liquid from its surroundings (see also "General information on jet pumps", 7 | ab1).

If one or several such jet mixers are correctly arranged, a three-dimensional flow is produced in the tank which mixes all of the contents homogeneously.

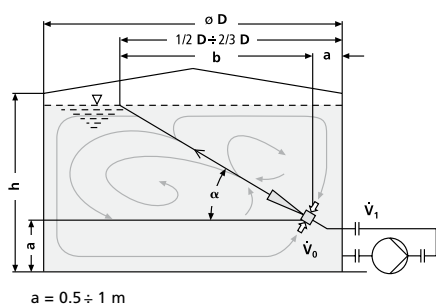
Jet mixers are simple and reliable, having no moving parts. Jet mixers are hardly subject to any wear.

ARRANGEMENT AND INSTALLATION

Jet mixers should be installed at the deepest possible point so that a good operation and an effective mixing is obtained even with a low liquid level.

A level of 1–2 m above the jet mixer is sufficient to avoid foaming. Fig. 1 shows an installation example in a tank. Fig. 2 shows a possible arrangement in a neutralization basin.

FIG. 1



For the evaluation of the number of mixers, following criteria are decisive:

- geometry and size of the tank or basin
- liquid to be mixed
- mixing time
- maximal and minimal liquid level

MIXING TIME

The mixing time amongst others, depends on the liquid contents of the tank and of the total delivered flow to the jet mixers.

It amounts to:

$$t \approx 0.3 \cdot \frac{I_E}{\Sigma \dot{V}}$$

t	Mixing time in h
I_E	Actual tank volume in m^3
$\Sigma \dot{V}$	Total delivered flow of the jet mixers in m^3/h

The calculation applies to pure water. The values have to be corrected for other liquids.

SELECTION OF THE CIRCULATION PUMP

The selection of the required circulation pump is determined by the effective motive liquid pressure Δp_1 and by the motive liquid flow \dot{V}_1 .

In determining the required motive liquid pressure Δp_1 , you must consider the two possible flow arrangements for the circulation pump:

1. The circulation pump **sucks in** the circulation liquid **from the tank** (fig. 3). The static liquid pressure H_{stat} in this case has no influence on the delivery head H as the inlet height at the suction connection is so arranged that $\Delta p_1 = H$.

FIG. 2

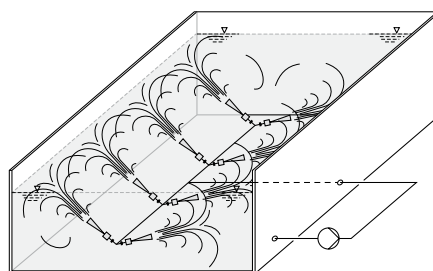


FIG. 3

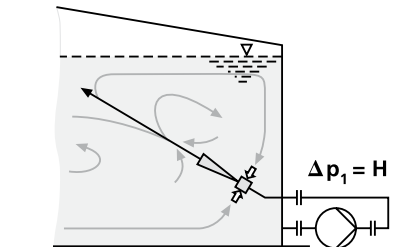
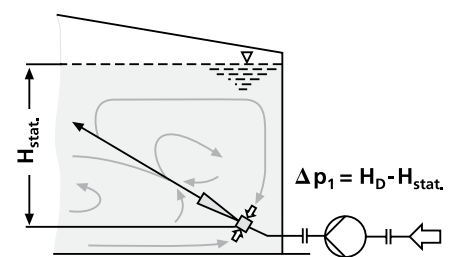


FIG. 4



2. The circulation pump **sucks in external liquid** and must deliver it against the static liquid pressure in the tank (fig. 4). In this case, the following shall apply:

$$\Delta p_1 = H_D - H_{stat}$$

H_D Delivery head of the pump

EXAMPLE OF DESIGN

GIVEN:

Tank diameter	$D = 3.5 \text{ m}$
Tank height	$h = 4 \text{ m}$
Useful volume	$I_N = 38.5 \text{ m}^3$
Actual tank volume	$I_E = 30 \text{ m}^3$
Mixing time	$t = 0.5 \text{ h}$ (double circulation per hour)

Motive liquid pressure $\Delta p_1 \leq 3 \text{ bar}$

Pump arrangement according to fig. 3

PARAMETERS TO BE FOUND: Mixer size and parameters of the circulation pump

SOLUTION: With the help of the mixing time we calculate the total delivered flow as follows:

$$\Sigma \dot{V} = 0.3 \cdot \frac{l_E}{t} = \frac{0.3 \cdot 30}{0.5} = 18 \text{ m}^3 / \text{h}$$

Taking into consideration $\Delta p_1 \leq 3$ bar, diagram fig. 5 shows a required motive liquid pressure Δp_1 of 2.5 bar for a total delivery flow of 18 m³/h and a motive liquid flow of 4.5 m³/h.

Mixer size 3-80 is selected.

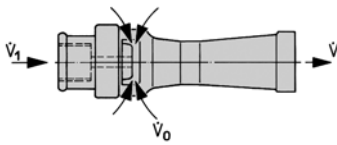
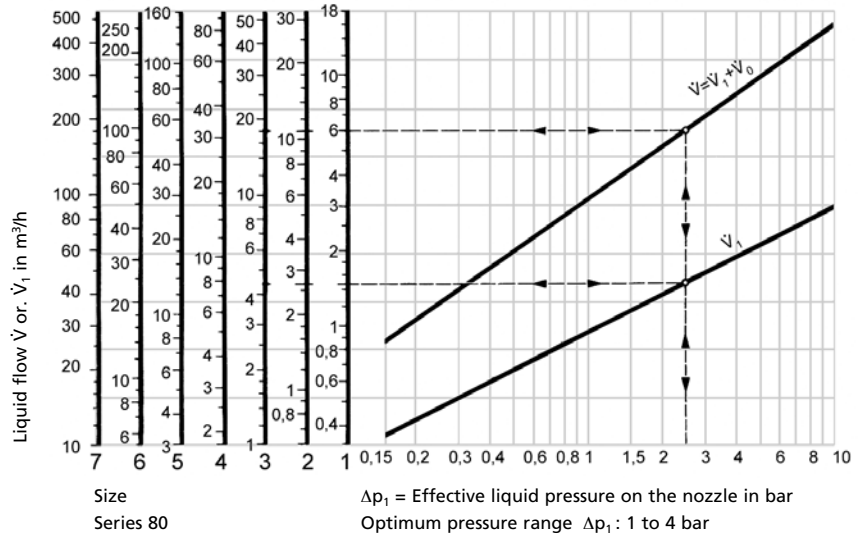


FIG. 5



CONNECTIONS, DIMENSIONS AND WEIGHTS

LIQUID JET MIXERS WITH THREADED CONNECTIONS TYPE 17.1

FIG. 6A

CAST IRON	Size	1-80	2-80	3-80	4-80	5-80	6-80	7-80
		Motive liquid connection	A	G 3/4	G 1	G 1 1/2	G 1 1/2	G 2
Dimensions in mm	a	170	220	265	345	400	520	610
	D	52	60	75	85	100	125	160
	f	20	25	24	24	30	33	40
Weight in kg		1	2	3	5	7	12	27

STANDARD CONSTRUCTIONS: I Housing: cast iron EN-GJL-200 (GG20), nozzles: red brass, threaded connections according to ISO 228, flanges according to DIN PN 10, II Housing: cast iron EN-GJL-200 (GG20), nozzles: stainless steel, threaded connections according to ISO 228, flanges according to DIN PN 10

FIG. 6B

STAINLESS STEEL	Size	1-80	2-80	3-80	4-80	5-80	6-80	7-80
		Motive liquid connection	A	G 3/4	G 1	G 1 1/2	G 1 1/2	G 2
Dimensions in mm	a	170	220	265	345	400	495	610
	D	45	55	55	63	79	112	140
	f	20	25	24	25	30	41	50
Weight in kg		1.4	2.8	2.8	4	7	18	31

STANDARD CONSTRUCTIONS: I Completely stainless steel 1.4571, II Completely stainless steel 1.4301, threaded connections according to ISO 228, flanges according to DIN PN 10

FIG. 6C

PLASTICS	Size	1-80	2-80	3-80	4-80	5-80	6-80	7-80
		Motive liquid connection	A	G 3/4	G 1	G 1 1/2	G 1 1/2	G 2
Dimensions in mm	a	170	220	265	345	400	495	610
	D	50	60	70	80	90	120	150
	f	20	25	24	25	30	41	50
Weight PVC in kg		0.4	0.7	1	1.5	2	4	6.5
Weight PP in kg		0.3	0.5	0.8	1.2	1.6	3	5
Weight PTFE in kg		0.5	1	1.5	2.3	3	5.8	10

STANDARD CONSTRUCTIONS: I Completely PVC, II Completely PP, III Completely PTFE, threaded connections according to ISO 228

SPECIAL CONSTRUCTIONS on request. Please indicate size, type and material in your order. For inquiries please use our questionnaire.

LIQUID JET MIXERS WITH FLANGED CONNECTIONS TYPE 27.1

FIG. 6D

CAST IRON	Size	1-80	2-80	3-80	4-80	5-80	6-80	7-80
		Motive liquid connection	A	20	25	40	40	50
Dimensions in mm	a	200	250	300	380	440	570	660
	D	52	60	75	85	100	125	160
	f	20	25	24	24	30	33	40
Weight in kg		2	3	5	7	11	19	33

FIG. 6E

STAINLESS STEEL	Size	1-80	2-80	3-80	4-80	5-80	6-80	7-80
		Motive liquid connection	A	20	25	40	40	50
Dimensions in mm	a	170	220	265	345	400	495	610
	D	45	55	55	63	79	112	140
	f	20	25	24	25	30	41	50
Weight in kg		2.2	3.5	4.0	5.5	9.5	22	35

FIG. 6F

PLASTICS	Size	1-80	2-80	3-80	4-80	5-80	6-80	7-80
		Motive liquid connection	A	20	25	40	40	50
Dimensions in mm	a	170	220	265	345	400	495	610
	D	50	60	60	60	76	106	130
	f	20	25	24	25	30	41	50
Weight in PVC kg		0.4	0.8	0.9	1.3	1.9	3.7	7.0
Weight in PP kg		0.3	0.6	0.7	1.0	1.5	3.0	5.5
Weight in PTFE kg		0.6	1.2	1.4	2.0	2.7	5.8	10.6

I Completely PVC, loose flanges: GF-UP, II Completely PP, loose flanges: GF-UP, III Completely PTFE