# Jet mixer systems

for tank mixing and blending

Liquid jet mixers are used to mix and circulate liquids. With jet mixers a three dimensional flow is achieved in the tank without producing a rotating motion.

Advantages

- High efficiency
- High operational safety
- Long life time
- No turning parts so little wear and tear
- Simple construction
- Available in any material used in the equipment
- Resistant to fouling

$$\Delta p_1 = H$$

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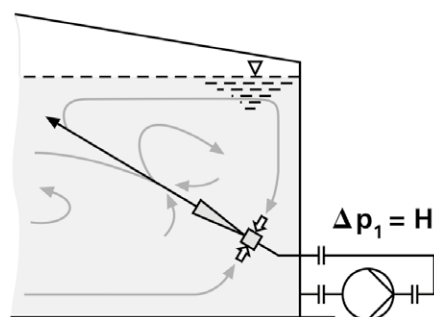
Liquid jet mixers

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", | abl 1).

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.

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

- geometry an 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 m³
$\Sigma \dot{V}$	Total delivered flow of the jet mixers in m³/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 $\Delta p_1 = H$.
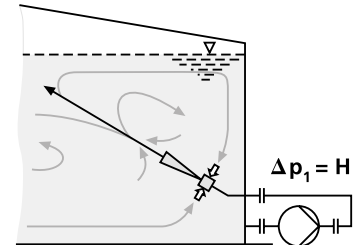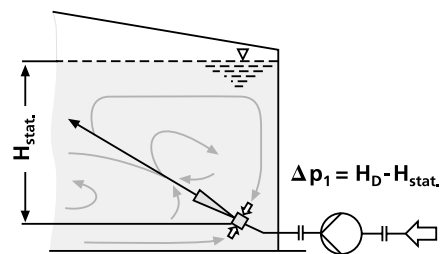
2. The circulation pump sucks in external liquid and must deliver it against the static liquid pressure in the tank (fig. 4). In this case, the following shall apply:

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

H_D — Delivery head of the pump

Example of Design

GIVEN:

Tank diameter	$D = 3.5$ m
Tank height	$h = 4$ m
Useful volume	$I_N = 38.5$ m³
Actual tank volume	$I_E = 30$ m³
Mixing time	$t = 0.5$ h (double circulation per hour)
Motive liquid pressure	$\Delta p_1 \leq 3$ bar

Pump arrangement according to fig. 3

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

FIG. 3

$\Delta p_1 = H$

FIG. 4

$H_{stat.}$

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

FIG. 1

ø D
1/2 D ÷ 2/3 D
b
a
α
$\dot{V}_1$
$\dot{V}_0$
h
a
a = 0.5 ÷ 1 m

FIG. 2

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

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

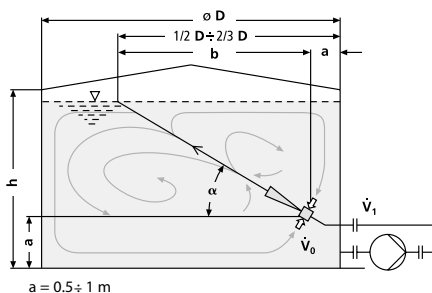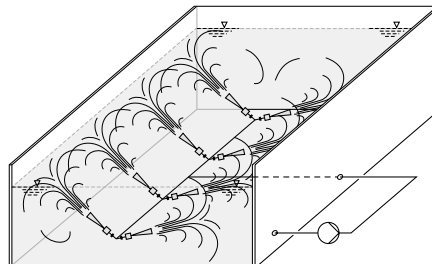Taking into consideration $\Delta p_1 \leq 3$ bar, diagram fig. 5 shows a required motive liquid pressure Δp_1 of 2.5 bar for a total delivery flow of 18 m³/h and a motive liquid flow of 4.5 m³/h.
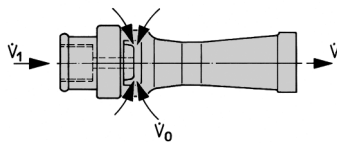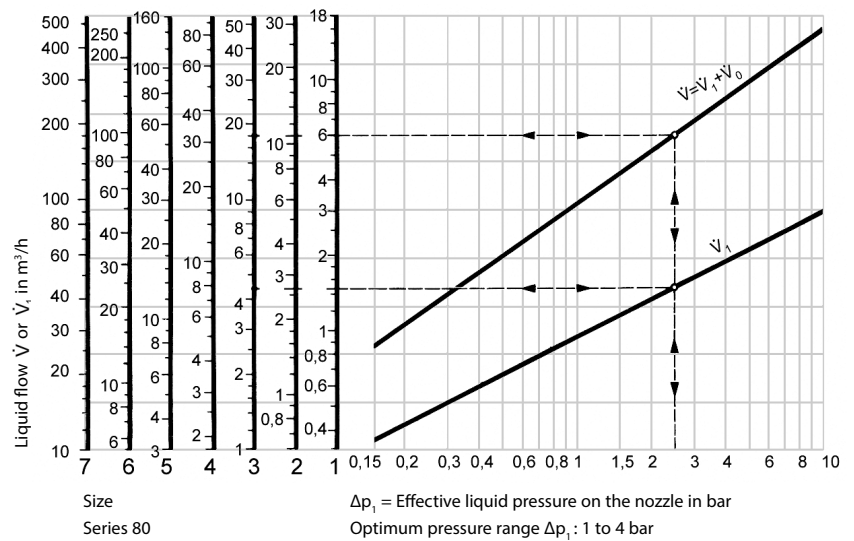
Mixer size 3-80 is selected.

FIG. 5

Size
Series 80

Δp_1 = Effective liquid pressure on the nozzle in bar

Optimum pressure range Δp_1 : 1 to 4 bar

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 11/2	G 11/2	G 2	G 3	G 4
Dimensions	a	170	220	265	345	400	520	610
in mm	D	52	60	75	85	100	125	160
	f	20	25	24	24	30	33	40
Weight in kg		1	2	3	5	7	13	24

STANDARD CONSTRUCTIONS: Housing: cast iron EN-GJL-200 (GG20), nozzles: stainless steel, threaded connections according to ISO 228, flanges according to EN1092-1

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 11/2	G 11/2	G 2	G 3	G 4
Dimensions	a	170	220	265	345	400	495	610
in mm	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 EN1092-1

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 11/2	G 11/2	G 2	G 3	G 4
Dimensions	a	170	220	265	345	400	495	610
in mm	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	7.5
Weight PP in kg		0.3	0.5	0.8	1	1.6	3	5
Weight PTFE in kg		0.5	1	1.5	2.3	3	6	10

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

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	80	100
Dimensions	a	200	250	300	380	440	570	660
in mm	D	52	60	75	85	100	125	160
Weight in kg		2	3	5	7	10	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	80	100
Dimensions	a	170	220	265	345	400	495	610
in mm	D	45	55	55	63	79	112	140
Weight in kg		2.2	3.5	4.5	5.5	9	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	80	100
Dimensions	a	170	220	265	345	400	495	610
in mm	D	50	60	60	60	76	106	130
Weight in PVC kg		0.4	0.8	0.9	1.3	1.9	3.7	5
Weight in PP kg		0.3	0.6	0.7	1	1.5	3	4
Weight in PTFE kg		0.6	1.2	1.4	2.0	2.7	5	7

I Completely PVC, loose flanges: GF-UP, II Completely PP, loose flanges: GF-UP, III Completely PTFE, flanges acc. to EN1092-1

SPECIAL CONSTRUCTIONS on request. Please indicate size, type and material in your order.

For inquiries please use our questionnaire.

Questionnaire
for liquid jet mixers
fm1

1. DIMENSIONS OF THE TANK OR BASIN

Volume of the tank or basin . . . . m³   Length . . . . mm

Diameter . . . . mm   Width . . . . mm

Height . . . . mm

2. LIQUID TO BE MIXED

Medium . . . .   Dyn. viscosity . . . . mPas

Temperature . . . . °C   Solid content . . . . g/l

Density . . . . kg/m³   Particle size . . . . mm

3. CIRCULATION PUMP

Liquid flow . . . . m³/h   Pressure at mixer . . . . bar g

4. MIXING REQUIREMENTS

Mixing time . . . . h

Further requirements . . . .

. . . .

. . . .

5. FURTHER DATA

MATERIAL OF CONSTRUCTION: . . . .

CONNECTIONS: **FLANGES ACCORDING TO:**

Flanges ☐   EN1092-1 ☐

Thread ☐   ASME lbs ☐

Others ☐   Others ☐

FURTHER NOTES: . . . .

. . . .

. . . .

Additional details, if required,   **Your inquiry no.** . . . .

are to be stated separately.   Offer submitted until . . . .

                                              Requested date of delivery . . . .

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