3. Force of impact

Spray force of impact, i.e. effect of the spray jet on a surface, is realized in kg/cm3. It depends on a nozzle's spray characteristics, flow rate and spray angle.

- Small forces of impact for wide-angle nozzles.
- Large forces of impact for flat fan nozzles and
- Maximum forces of impact for solid stream nozzles.

In order to be able to determine the force of impact, the total spray force has to be calculated using the following formula:

$$I\ ges.\ theor. = 0{,}024 \times \dot{V} \times \sqrt{P}$$

I ges. theor. = Theoretical total foce of impact
$\dot{V}$ = Flow rate (l/min.)
p = Operating pressure (bar)

Afterwards take the corresponding %-ratio from the adjoining chart, and multiply it with the theoretical total force of impact.

$$I\text{-Düse} = I\ ges.\ theor. \times \frac{I\%}{100}$$

Solid stream nozzles feature maximum forces of impact. They are calculated as follows:

$$I\text{-Düse} = 1{,}9 \times P\ [kg/cm^2]$$

Illu. 8
All data - 30 cm distance to the nozzle

Spray pattern	Spray angle	Total force of impact	Force of impact in % per cm²
Solid stream	0°	96% to 99%	-
Flat fan	15° 25° 35° 40° 50° 65° 80°	95% to 90%	30% 18% 13% 12% 10% 7% 5%
Full cone	15° 30° 50° 65° 80° 100°	85% 81% 77% 70% 61% 50%	11% 2% 1% 0,4% 0,2% 0,1%
Hollow cone	60° 80°	50%	1-2%

4. Pipes - Pressure losses

Average pressure losses through frictions in fittings (expressed as m - pipe length)

Illu. 9

Nominal width	Inner diameter (mm)	Gate valve (open) (m)	Ball valve (open) (m)	45° bow (m)
1/8"	6.8	0.05	2.4	0.11
1/4"	9.2	0.06	3.4	0.15
1/2"	15.8	0.11	5.7	0.24
3/4"	21	0.13	7.0	0.30
1"	27	0.17	9.0	0.37
1 1/4"	35	0.23	11.8	0.49
1 1/2"	41	0.26	13.8	0.58
2"	53	0.34	17.7	0.73
2 1/2"	63	0.40	21	0.88
3"	78	0.49	26	1.1
4"	102	0.64	34	1.4
5"	128	0.82	43	1.8
6"	154	0.98	52	2.2
Nominal width	Inner diameter (mm)	T- piece stan-dard (m)	T-piece bow 50 % red. (m)	T-piece angled passage (m)
1/8"	6.8	0.12	0.23	0.43
1/4"	9.2	0.20	0.34	0.67
1/2"	15.8	0.34	0.52	1.0
3/4"	21	0.43	0.64	1.3
1"	27	0.55	0.79	1.6
1 1/4"	35	0.70	1.1	2.1
1 1/2"	41	0.82	1.2	2.5
2"	53	1.1	1.6	3.2
2 1/2"	63	1.3	1.9	3.8
3"	78	1.6	2.3	4.7
4"	102	2.1	3.1	6.2
5"	128	2.6	3.9	7.7

Illu. 10 Pressure losses in pipes

Vol. (l/min.)	Presure losses (bar) for different pipe diameters (in relation to a pipe length of 10 m)														
	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"	8"
1	0.07															
1.5	0.16	0.04														
2	0.26	0.06														
2.5	0.40	0.08														
3	0.56	0.12	0.03													
4	0.96	0.21	0.05	0.02												
6	2.0	0.45	0.10	0.03												
8	3.5	0.74	0.17	0.05	0.01											
10		1.2	0.25	0.08	0.02											
12		1.7	0.35	0.11	0.03											
15		2.6	0.54	0.17	0.04	0.01										
20			0.92	0.28	0.07	0.02										
25			1.2	0.45	0.11	0.03										
30			2.1	0.62	0.15	0.04	0.01									
40				1.1	0.25	0.08	0.02									
60					0.54	0.16	0.04	0.02	0.006							
80					0.93	0.28	0.07	0.03	0.009							
100						0.43	0.12	0.05	0.01							
115						0.58	0.14	0.06	0.015							
130						0.72	0.18	0.08	0.02	0.01						
150							0.23	0.10	0.03	0.012						
170							0.29	0.13	0.04	0.016						
190							0.36	0.16	0.05	0.02						
230							0.50	0.23	0.07	0.03	0.009					
260								0.32	0.09	0.04	0.01					
300								0.38	0.11	0.04	0.02	0.007				
340								0.50	0.14	0.06	0.02	0.009				
380								0.61	0.18	0.07	0.03	0.01				
470									0.28	0.11	0.04	0.02	0.009			
570									0.39	0.15	0.05	0.03	0.01			
750									0.64	0.26	0.09	0.04	0.02	0.007		
950											0.14	0.06	0.03	0.01		
1,150											0.19	0.09	0.05	0.02		
1,500												0.16	0.06	0.03	0.01	
1,900													0.13	0.04	0.02	
2,800														0.09	0.03	0.009
3,800														0.16	0.06	0.02
7,500															0.23	0.06