

Side branch

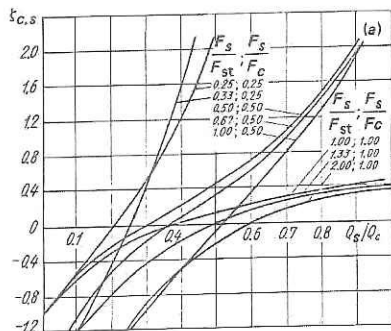
$$\zeta_{c,s} = \frac{\Delta p_s}{\rho w_s^2/2} = a_1 \left(\frac{Q_s}{Q_c} \right)^2 + b_1 \frac{Q_s}{Q_c} + c_1$$

see graph a; for a_1 , b_1 , and c_1 , see the table

$$\zeta_s = \frac{\Delta p_s}{\rho w_s^2/2} = \frac{\zeta_{c,s}}{(Q_s F_c / Q_c F_s)^2}$$

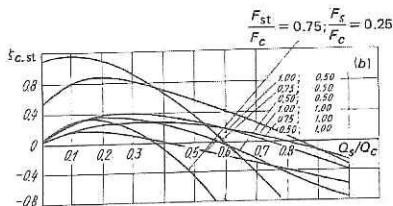
Values of $\zeta_{c,s}$

| $\frac{F_s}{F_c}$ | $\frac{Q_s}{Q_c}$ | | | | | | | | |
|-------------------|-------------------|-------|-------|-------|-------|------|------|------|-------|
| $\frac{F_s}{F_c}$ | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 0.25 (0.25) | -0.50 | 0 | 0.50 | 1.20 | 2.20 | 3.70 | 5.80 | 8.40 | 11.40 |
| 0.33 (0.25) | -1.20 | -0.40 | 0.40 | 1.60 | 3.00 | 4.80 | 6.80 | 8.90 | 11.00 |
| 0.50 (0.50) | -0.50 | -0.20 | 0 | 0.25 | 0.45 | 0.70 | 1.00 | 1.50 | 2.00 |
| 0.67 (0.50) | -1.00 | -0.60 | -0.20 | 0.10 | 0.30 | 0.60 | 1.00 | 1.45 | 2.00 |
| 1.00 (0.50) | -2.15 | -1.45 | -0.95 | -0.50 | 0 | 0.40 | 0.80 | 1.30 | 1.90 |
| 1.00 (1.00) | -0.60 | -0.30 | -0.10 | -0.04 | 0.13 | 0.21 | 0.29 | 0.36 | 0.42 |
| 1.33 (1.00) | -1.20 | -0.80 | -0.40 | -0.20 | 0 | 0.16 | 0.24 | 0.32 | 0.38 |
| 2.00 (1.00) | -2.10 | -1.40 | -0.90 | -0.50 | -0.20 | 0 | 0.20 | 0.25 | 0.30 |



Values of $\zeta_{c,st}$

| $\frac{F_{st}}{F_c}$ | $\frac{Q_s}{Q_c}$ | | | | | | | | |
|----------------------|-------------------|------|------|-------|-------|-------|-------|-------|-------|
| $\frac{F_{st}}{F_c}$ | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 0.75 (0.25) | 0.30 | 0.30 | 0.20 | -0.10 | -0.45 | -0.92 | -1.45 | -2.00 | -2.60 |
| 1.00 (0.50) | 0.17 | 0.16 | 0.10 | 0 | -0.08 | -0.18 | -0.27 | -0.37 | -0.46 |
| 0.75 (0.50) | 0.27 | 0.35 | 0.32 | 0.25 | 0.12 | -0.03 | -0.23 | -0.42 | -0.58 |
| 0.50 (0.50) | 1.15 | 1.10 | 0.90 | 0.65 | 0.35 | 0 | -0.40 | -0.80 | -1.30 |
| 1.00 (1.00) | 0.18 | 0.24 | 0.27 | 0.26 | 0.23 | 0.18 | 0.10 | 0 | -0.12 |
| 0.75 (1.00) | 0.75 | 0.36 | 0.38 | 0.35 | 0.27 | 0.18 | 0.05 | -0.08 | -0.22 |
| 0.50 (1.00) | 0.80 | 0.87 | 0.80 | 0.68 | 0.55 | 0.40 | 0.25 | 0.08 | -0.10 |



Straight passage

$$\zeta_{c,st} = \frac{\Delta p}{\rho w_{st}^2/2} = a_2 \left(\frac{Q_s}{Q_c} \right)^2 + b_2 \frac{Q_s}{Q_c} + c_2$$

See graph b; for a_2 , b_2 , and c_2 , see the table

$$\zeta_{st} = \frac{\Delta p_{st}}{\rho w_{st}^2/2} = \frac{\zeta_{c,st}}{(1 - Q_s/Q_c)^2 (F_c/F_{st})^2}$$

| $\frac{F_s}{F_{st}}$ | $\frac{F_{st}}{F_c}$ | $\frac{F_s}{F_c}$ | a_2 | b_2 | c_2 | a_2 | b_2 | c_2 |
|----------------------|----------------------|-------------------|-------|-------|-------|-------|-------|-------|
| 0.25 | 1.00 | 0.25 | 19.82 | -5.27 | -0.03 | -4.38 | 0.65 | 0.32 |
| 0.33 | 0.75 | 0.25 | 11.43 | 3.97 | -1.76 | -0.45 | -0.39 | 0.22 |
| 0.50 | 1.00 | 0.50 | 1.96 | 1.04 | -0.58 | -1.70 | 0.57 | 0.25 |
| 0.57 | 0.75 | 0.50 | 1.96 | 1.64 | -1.05 | -2.68 | 0.42 | 1.23 |
| 1.00 | 0.50 | 0.50 | -0.63 | 5.55 | -2.65 | -1.27 | 0.88 | 0.11 |
| 1.00 | 1.00 | 1.00 | -1.55 | 2.88 | -0.90 | 0.16 | -1.30 | 0.84 |
| 1.33 | 0.75 | 1.00 | -2.64 | 4.54 | -1.60 | -2.68 | -0.42 | 1.23 |
| 2.00 | 0.50 | 1.00 | -4.46 | -7.41 | -2.77 | | | |