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Flow from a vertical slice

Scope

The primary variables which govern the angle of outflow and contraction coefficient for a vertical slice are shown in Fig. 1. The depth B may be to a free surface or to a rigid boundary. If this upper boundary is inclined, the angle of inclination may influence the outflow if the ratio b/B is near unity.

Fig. 2 shows the angle of outflow, β , as a function of the relative bottom lip extension, L/b and the geometric ratio b/B . Fig. 3 is a companion chart for determining the contraction coefficient. Fig. 4 provides a comparison between the theoretical angle of outflow and data reported from laboratory experiments. The information presented in Figs. 2 and 3 was derived for a nonviscous, ideal fluid and can be used to predict high velocity outflows of dilute fiber suspensions in water, provided that the effects of gravity and surface tension are small and the flow is unobstructed for a distance of several times the slice opening b .

Safety precautions

No safety precautions have been specified for use with this technical information paper.

Content

Example 1

- To obtain angle of outflow and thickness of the jet for a headbox with a plain vertical endwall and slice lip:
- Operating data:
Depth of stock at the slice $B = 500$ mm
Slice opening $b = 20$ mm
Bottom lip extension $L = 10$ mm
 - Calculate geometric ratios:
Relative slice opening $b/B = 0.040$
Bottom lip extension $L/b = +0.5$
 - Enter Fig. 2 with $L/b = 0.5$ and $b/B = 0.040$ (between curves for $b/B = 0$ and $b/B = 0.20$) to get $\beta = 9.0^\circ$.
 - Enter Fig. 3 with same geometric ratios to obtain $C_c = 0.62$.
 - The thickness of the jet then is $d = C_c b = 0.62 (20) = 12.4$ mm.

Example 2

To obtain angle of outflow and thickness of jet for a headbox with a curved slice terminating with a vertical slice lip:

a. Operating data:

Depth of stock at the slice $B = 28$ mm (This is the opening beneath the curved slice plate at the vertical slice lip. If the slice plate is not essentially horizontal, the prediction from the data will be approximate only. However, except for $b/B > 0.8$, the error will be very small.)

Slice opening $b = 20$ mm

Bottom lip extension $L = 16$ mm

b. Calculate geometric ratios:

Relative slice opening $b/B = 0.71$

Bottom lip extension $L/b = +0.8$

c. Enter Fig. 2 with geometric ratios to obtain $\beta = 3.9^\circ$.

d. Enter Fig. 3 with geometric ratios to obtain $C_c = 0.697$.

e. The thickness of the jet then is $d = C_c b = 0.697 (20) = 13.9$ mm.

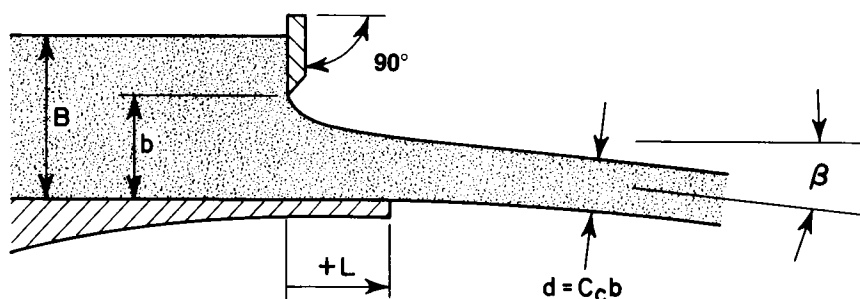


Fig. 1. Dimensions for flow from a vertical slice.

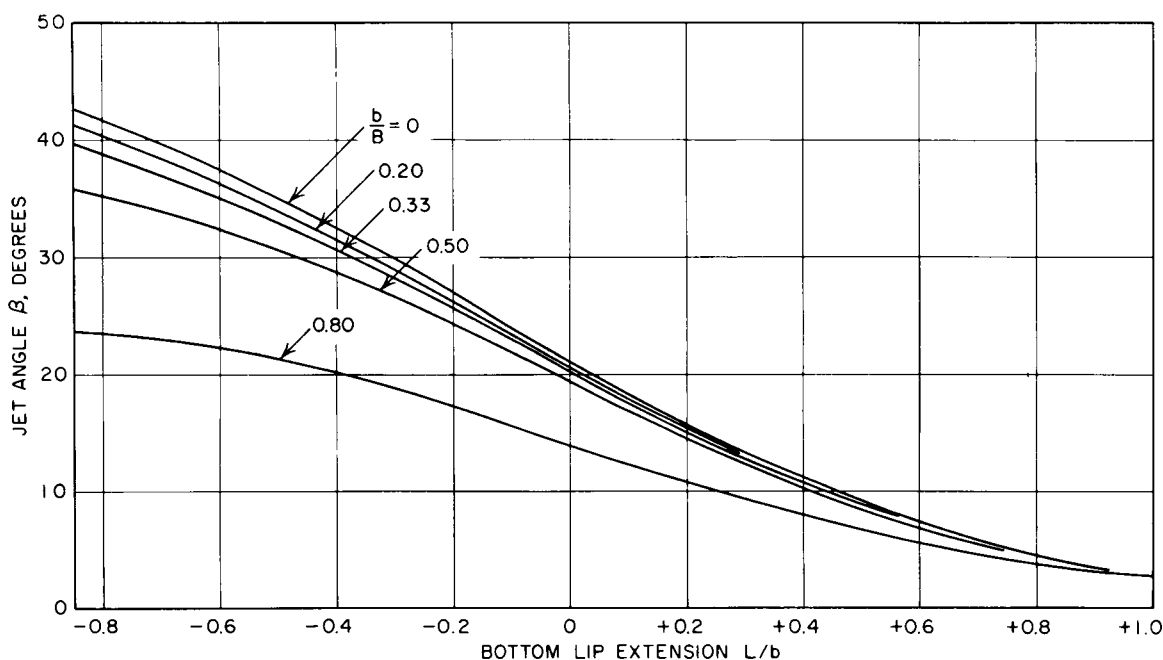


Fig. 2. Theoretical angle of outflow from a rectangular headbox.