TABLE 15–2

Empirical correlations for the average Nusselt number for forced convection over a flat plate and circular and noncircular cylinders in cross flow

(From Jakob, Ref. 12, and Zukauskas, Ref. 17.)

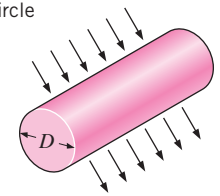
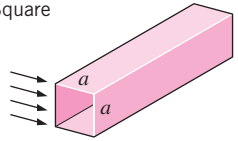
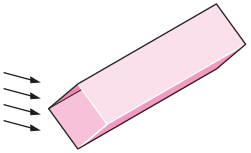
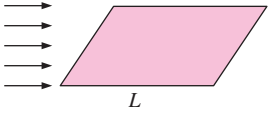
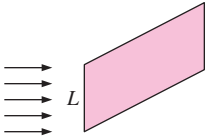
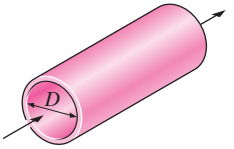
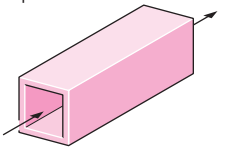
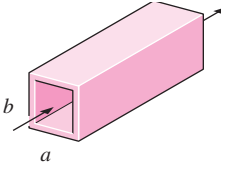
Cross-section of the cylinder	Fluid	Range of Re	Nusselt number
Circle 	Gas or liquid	0.4–4 4–40 40–4000 4000–40,000 40,000–400,000	$Nu = 0.989\ Re^{0.330}Pr^{1/3}$ $Nu = 0.911\ Re^{0.385}Pr^{1/3}$ $Nu = 0.683\ Re^{0.466}Pr^{1/3}$ $Nu = 0.193\ Re^{0.618}Pr^{1/3}$ $Nu = 0.027\ Re^{0.805}Pr^{1/3}$
Square 	Gas	5000–100,000	$Nu = 0.102\ Re^{0.675}Pr^{1/3}$
Square (tilted 45°) 	Gas	5000–100,000	$Nu = 0.246\ Re^{0.588}Pr^{1/3}$
Flat plate 	Gas or liquid	$0–5 \times 10^5$ $5 \times 10^5–10^7$	$Nu = 0.664\ Re^{1/2}Pr^{1/3}$ $Nu = (0.037\ Re^{4/5} - 871)Pr^{1/3}$
Vertical plate 	Gas	4000–15,000	$Nu = 0.228\ Re^{0.731}Pr^{1/3}$

TABLE 15–3

Nusselt number of fully developed laminar flow in circular tubes and rectangular channels

Cross-section of the tube	Aspect ratio	Nusselt number
Circle 	—	4.36
Square 	—	3.61
Rectangle 	a/b — 1 2 3 4 6 8 ∞	 3.61 4.12 4.79 5.33 6.05 6.49 8.24