Int. J. Heat Mass Transfer. Vol. 12, pp. 663–664. Pergamon Press 1969. Printed in Great Britain

LETTERS TO THE EDITORS

COMMENTS ON "HEAT TRANSFER AND PRESSURE DROP IN HORIZONTAL ANNULAR TWO-PHASE TWO-COMPONENT FLOW"

R. H. PLETCHER and H. N. MCMANUS, JR., *Int. J. Heat Mass Transfer* **11** (7), 1087–1104 (1968).

IN A RECENT article Pletcher and McManus [1] presented interesting correlations of data for heat transfer during air–water flow in pipes. The line in their Fig. 20 is given almost exactly by

$$\frac{\bar{h}}{\phi_L} = 5000\left\{X\left(\frac{\dot{W}_a}{\dot{W}_L}\right)^{0\cdot4}\right\}^2. \quad (1)$$

The Martinelli parameter X can be written

$$X = \left(\frac{\dot{W}_L}{\dot{W}_a}\right)^{0\cdot875}\left(\frac{\rho_a}{\rho_L}\right)^{0\cdot5}\left(\frac{\mu_L}{\mu_a}\right)^{0\cdot125} \quad (2)$$

where a smooth tube surface is assumed. Substituting equation (2) in (1) gives

$$\frac{\bar{h}}{\phi_L} \propto \left(\frac{\mu_L}{\mu_a}\right)^{0\cdot25}\left\{\left(\frac{\dot{W}_L}{\dot{W}_a}\right)^{0\cdot475}\left(\frac{\rho_a}{\rho_L}\right)^{0\cdot5}\right\}^2$$

which is approximately proportional to

$$\left(\frac{\mu_L}{\mu_a}\right)^{0\cdot25}\frac{\dot{W}_L}{\dot{W}_a}\frac{\rho_a}{\rho_L}$$

i.e. to

$$\left(\frac{\mu_L}{\mu_a}\right)^{0\cdot25}\frac{Q_L}{Q_a}$$

where Q_L and Q_a are the volume flowrates of water and air respectively. The writer therefore suggests that plots of $\bar{h}/\phi_L$ against Q_L/Q_a or $Q_L/(Q_a + Q_L)$ and $\bar{h}$ against $Q_L/(Q_a + Q_L)$ might give a more meaningful correlation of the data than the type of plots used in Fig. 20.

1. R. H. PLETCHER and H. N. MCMANUS JR., Heat transfer and pressure drop in horizontal annular two-phase two-component flow, *Int. J. Heat Mass Transfer*, **11**, 1086–1104 (1968).

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REJOINDER

CHISHOLM has made an interesting and correct observation concerning the parameter, $X(\dot{W}_a/\dot{W}_L)^{0\cdot4}$, used to correlate data in [1] for heat transfer to horizontal annular water–air flow. For the results in [1], the Martinelli parameter X was actually computed according to

$$X = \left(\frac{\dot{W}_L}{\dot{W}_a}\right)^{0\cdot4}\left(\frac{\rho_a}{\rho_L}\right)^{0\cdot5}\left(\frac{\mu_L}{\mu_a}\right)^{0\cdot125} \quad (1)$$

(see [1] for nomenclature) which results from computing the single phase turbulent flow friction factor according to an equation of the form

$$f \propto \frac{C}{Re^{0\cdot2}} \quad (2)$$

where C is a constant. Thus, the parameter $X(\dot{W}_a/\dot{W}_L)^{0\cdot4}$ can be reduced to

$$\left(\frac{\mu_L}{\mu_a}\right)^{0\cdot1}\left(\frac{Q_L}{Q_a}\right)^{0\cdot5} \quad (3)$$

without making the approximation indicated by Chisholm. Q_L and Q_a are the volume flow rates of water and air respectively.

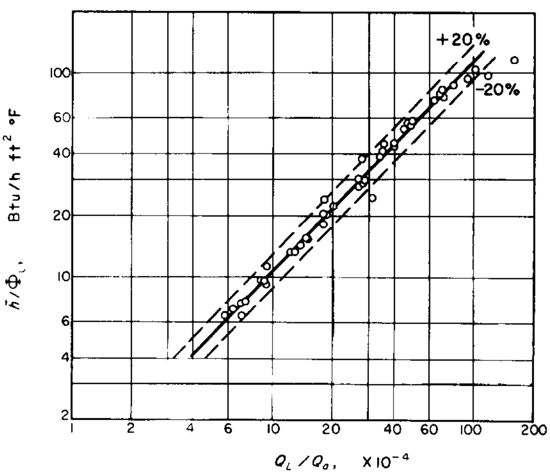

FIG. 1. Correlation of measured average heat-transfer coefficients from [1] based on Q_L/Q_a.