DESIGN GUIDELINES PREDICTION OF REYNOLDS NUMBER FOR TUBE SIDE FLOW OF WATER BY NOMOGRAPH

— Dr.G.K.Roy

Predicition of Reynolds number is of significance to problems of fluid mechanics and heat transfer (internal water flow). In addition to tube diameter and tube side velocity, this dimensionless group contains the kinematic viscosity term which is essentially a function of temperature. Bastawissi has given the following correlation to calculate the kinematic viscos(v) of liquid water over the temperature range 25°C to 250°C.

$$v = 0.168 \, T^{-0.88} \qquad ... (1)$$

With equation (1), the expression for Reynolds number (NR_e) becomes,

$$NR_e = 5.95 \, D \, U \, T^{0.88} \qquad ... (2)$$

Where D = tube diameter in cm.

U = water velocity in tube in cm/sec.

T = water temperature in °C

Based on equation (2), a nomograph (Figure 1) has been prepared for a quick estimate of Reynolds number, which thereafter can be used for subsequent computations like flow and heat transfer characteristics of water.

RANGE OF APPLICABILITY

The range of applicability of the nomograph is presented in Table 1.

Table 1
The range of applicability of the nomograph

Sl.	Variable	Unit	Range of applicability
1.	D	cm	1 - 300
2.	U	cm/sec.	10 - 2000
3	T	°C	25 - 250

The ranges of variables cover the normal operating range encountered in industrial flow and heat transfer situations.

ACCURACY OF THE NOMOGRAPH

The values of Reynolds number obtained from the nomograph have been found to agree well with their respective values calculated from equation (2).

Example:

D = 10 cm

U = 50 cm/sec.

T = 35°C

The value of Reynolds number can be calculated with a help of equation (2) and the same can be compared with the value obtained from nomograph.

This is shown as follows :

From equation (2)

$$NR_e = 5.95 \, D \, U \, T^{0.88}$$

$$= 5.95 \, (10) \, (50) \, (35)^{0.88}$$

$$= 67962$$

From nomograph (Figure 1)

$$NR_e = 70000.$$

Percentage deviation of nomograph value from the calclated ones,

$$= \frac{70000 - 67962}{67962} = 3.00$$

Reference

1. A.E. Bastawissi, Chem. Engg, Sept, 14 (1987) 116.

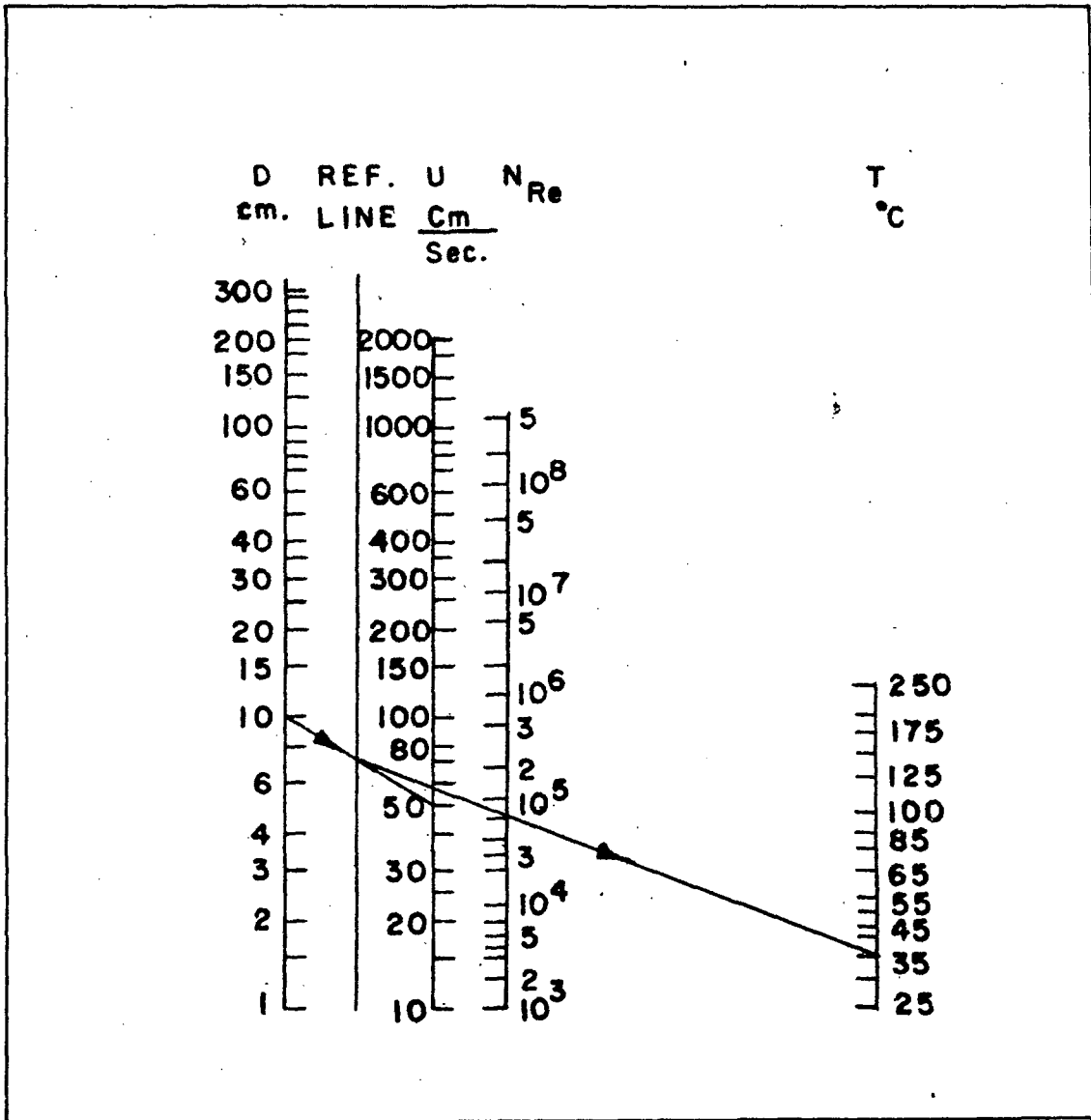*The author is Professor, Department of Chemical Engineering, Regional Engineering College, Rourkela - 769 008.*

FIG. 1 PREDICTION OF REYNOLDS NUMBER
FOR WATER BY NOMOGRAPH.