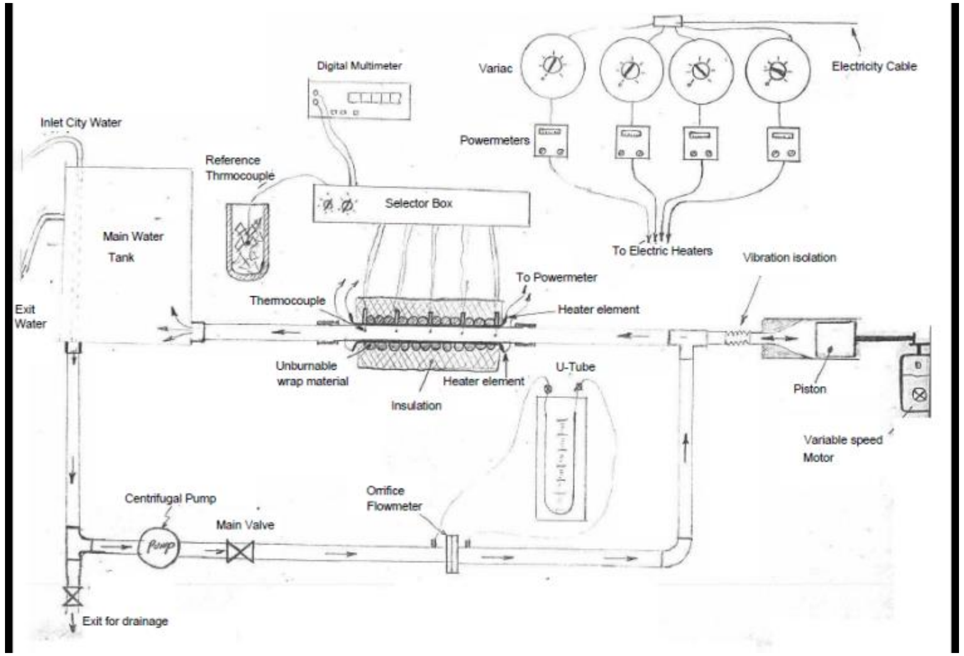
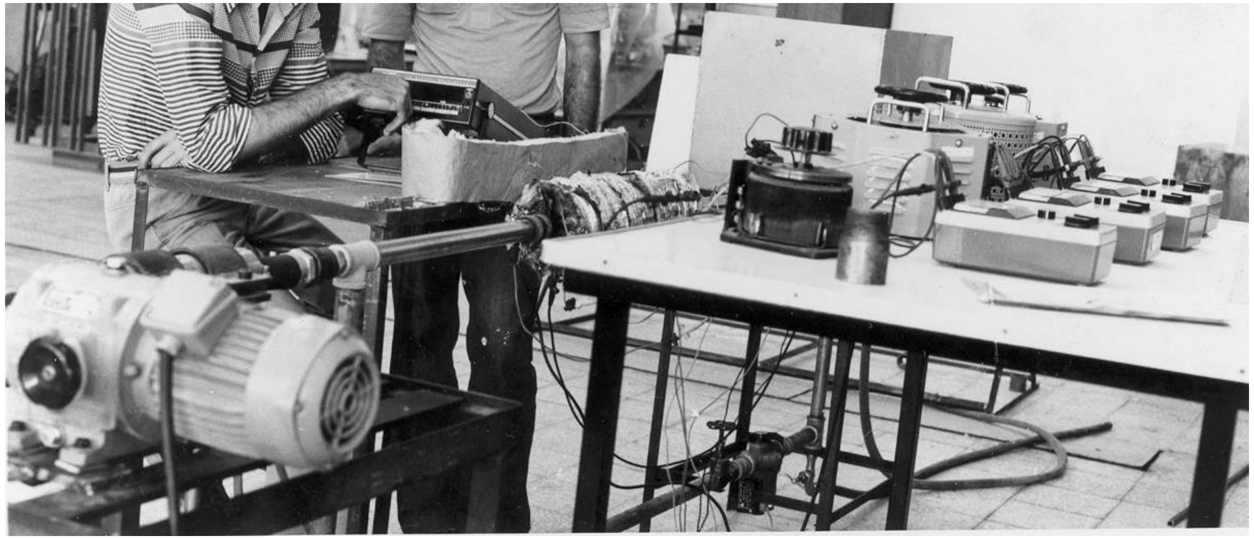
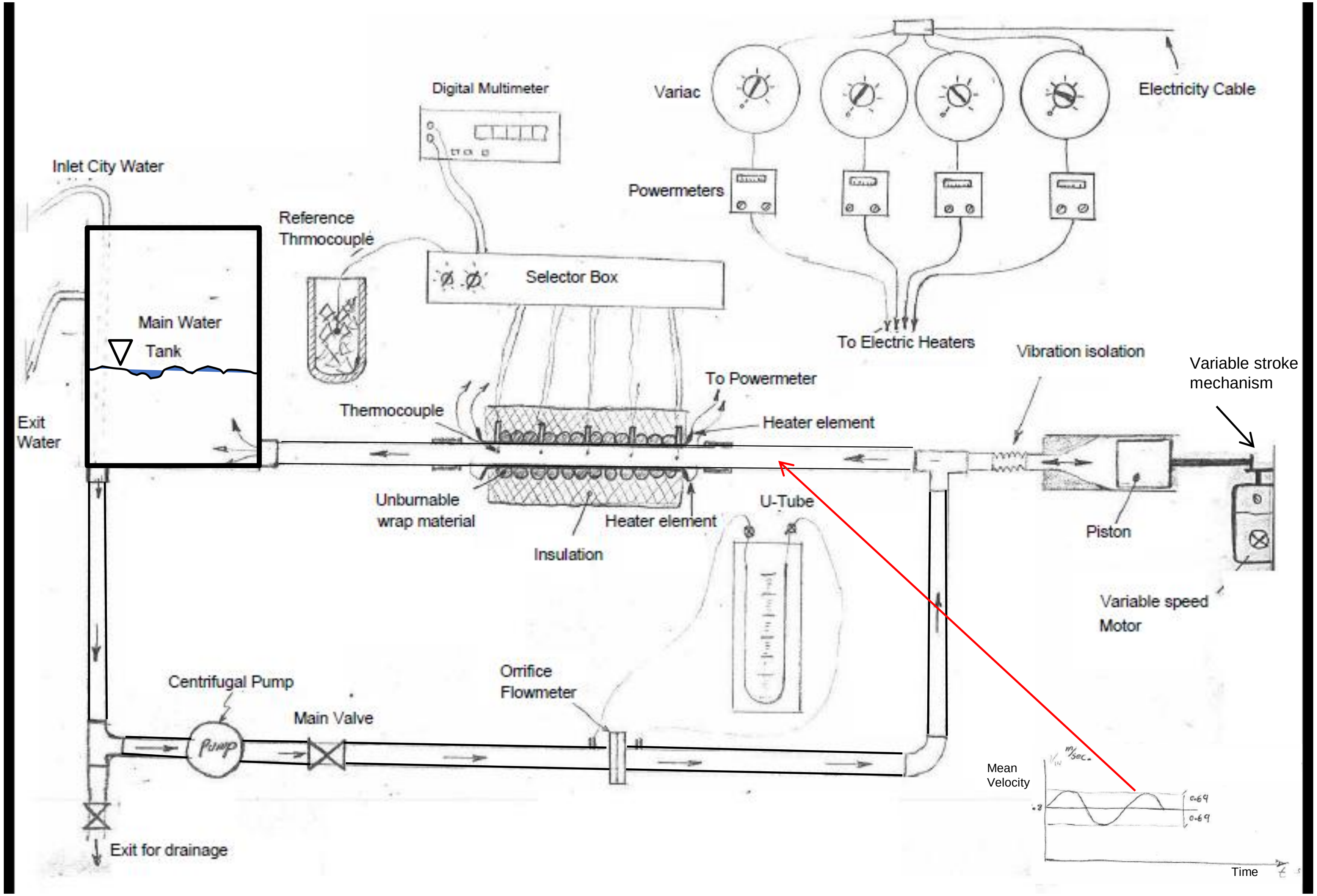
Heat Transfer Enhancement: Pulsatile Flow

(B. Chehroudi and M. Ghiassian)





Heat Transfer Enhancement: Pulsatile Flow (Chehroudi)



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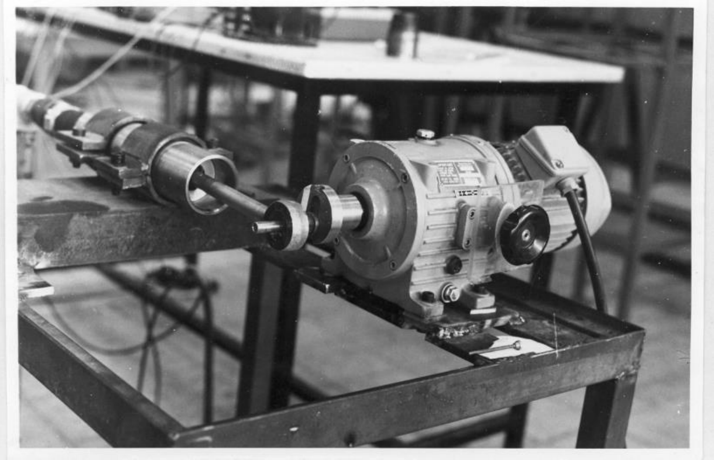

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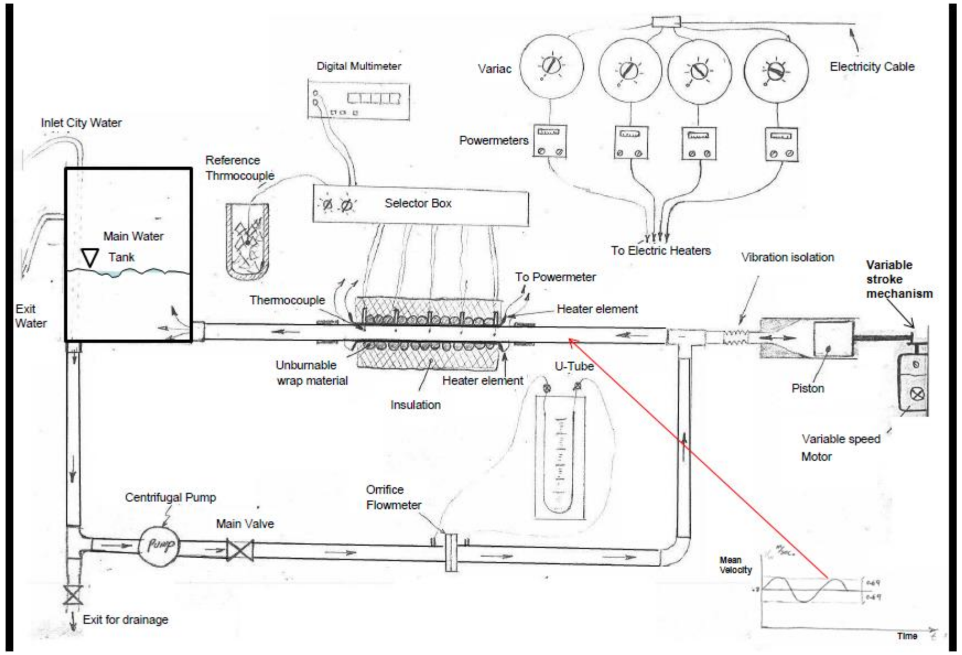

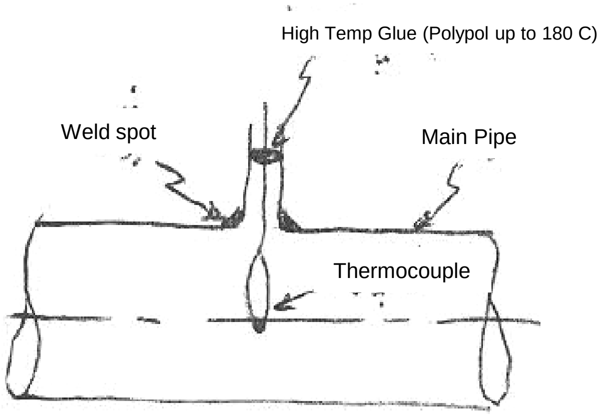

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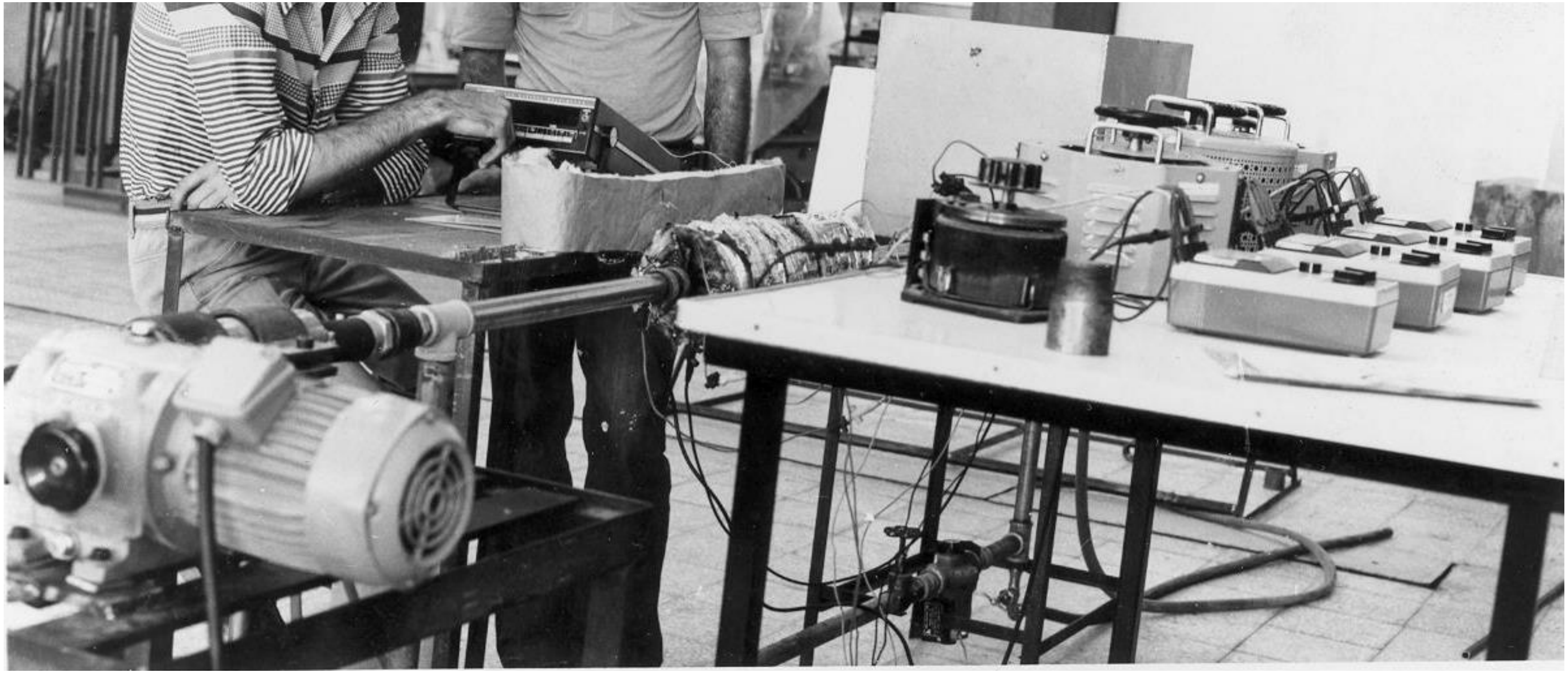

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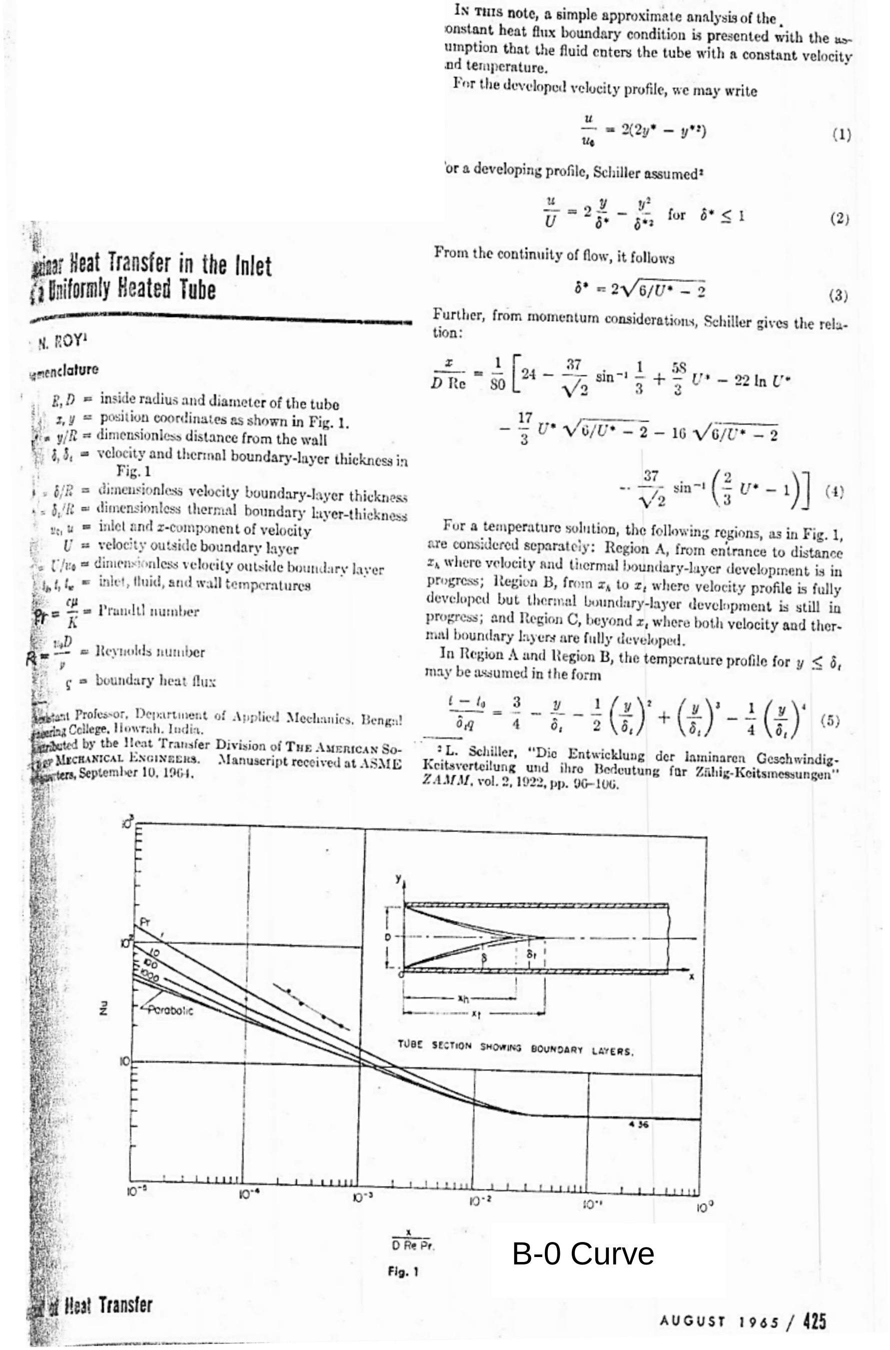

inar Heat Transfer in the Inlet a Uniformly Heated Tube

N. ROY[1]

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R, D = inside radius and diameter of the tube
x, y = position coordinates as shown in Fig. 1.
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$Pr = \frac{c\mu}{K}$ = Prandtl number
$R = \frac{u_0 D}{\nu}$ = Reynolds number
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[1] Assistant Professor, Department of Applied Mechanics, Bengal Engineering College, Howrah, India.
Contributed by the Heat Transfer Division of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Manuscript received at ASME Headquarters, September 10, 1964.

IN THIS note, a simple approximate analysis of the constant heat flux boundary condition is presented with the assumption that the fluid enters the tube with a constant velocity and temperature.

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Further, from momentum considerations, Schiller gives the relation:

$$\frac{x}{D\,\mathrm{Re}} = \frac{1}{80}\left[24 - \frac{37}{\sqrt{2}}\sin^{-1}\frac{1}{3} + \frac{58}{3}U^* - 22\ln U^* - \frac{17}{3}U^*\sqrt{6/U^* - 2} - 16\sqrt{6/U^* - 2} - \frac{37}{\sqrt{2}}\sin^{-1}\left(\frac{2}{3}U^* - 1\right)\right] \quad (4)$$

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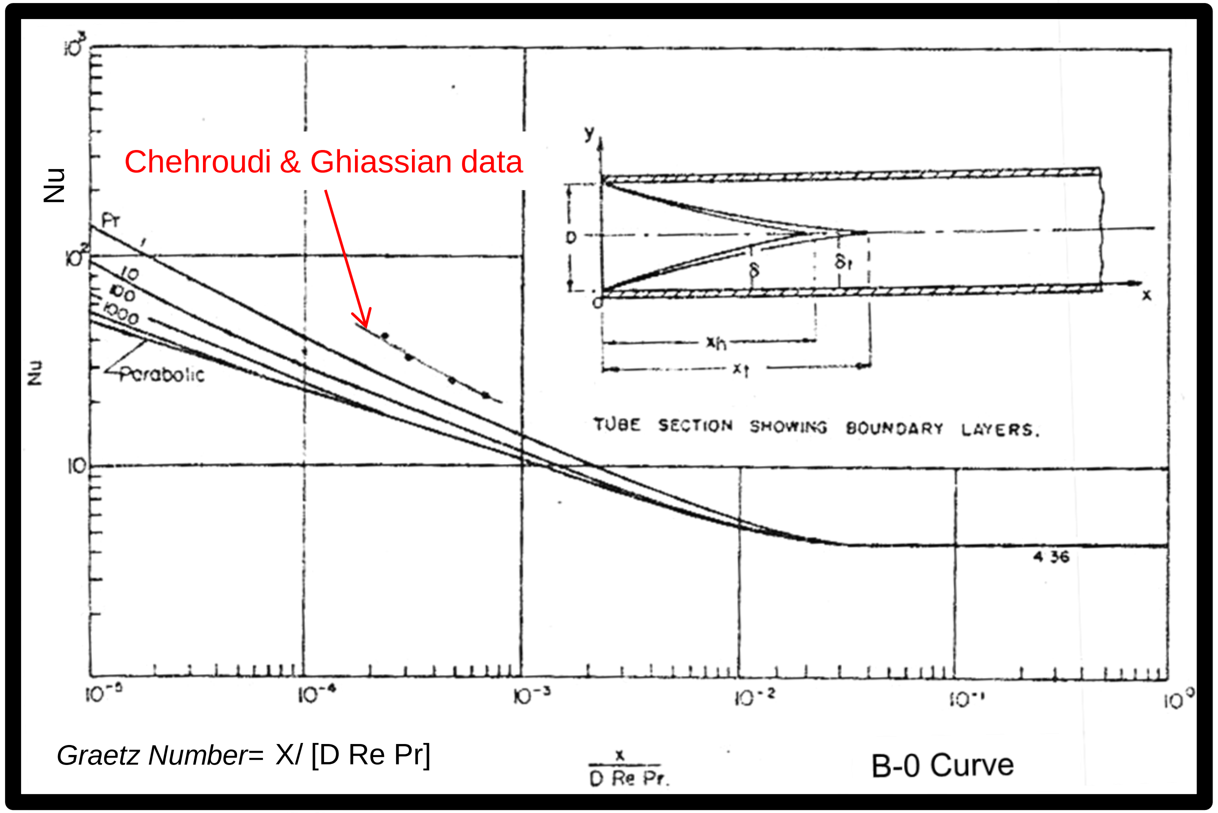
Fig. 1

B-0 Curve



Roy, D. N., Laminar heat transfer in the inlet of a uniformly heated tube, *Trans. ASME, J. Heat Transfer*, vol. 84, p.425, 1965.

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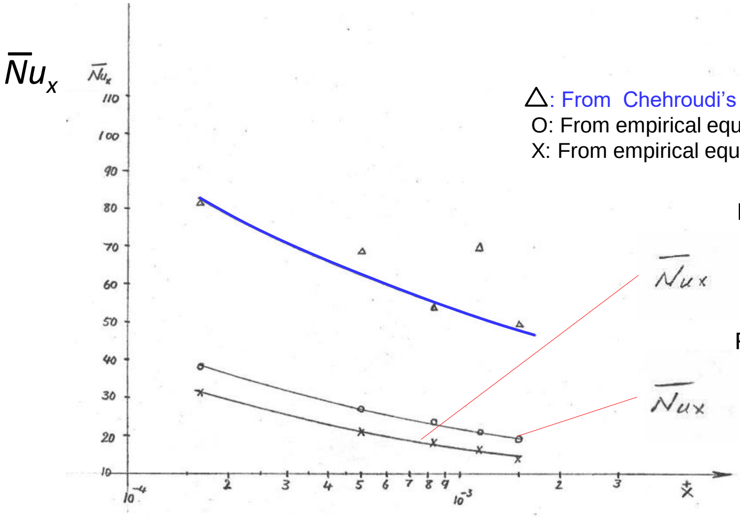


Formula A (8-62 of textbook)

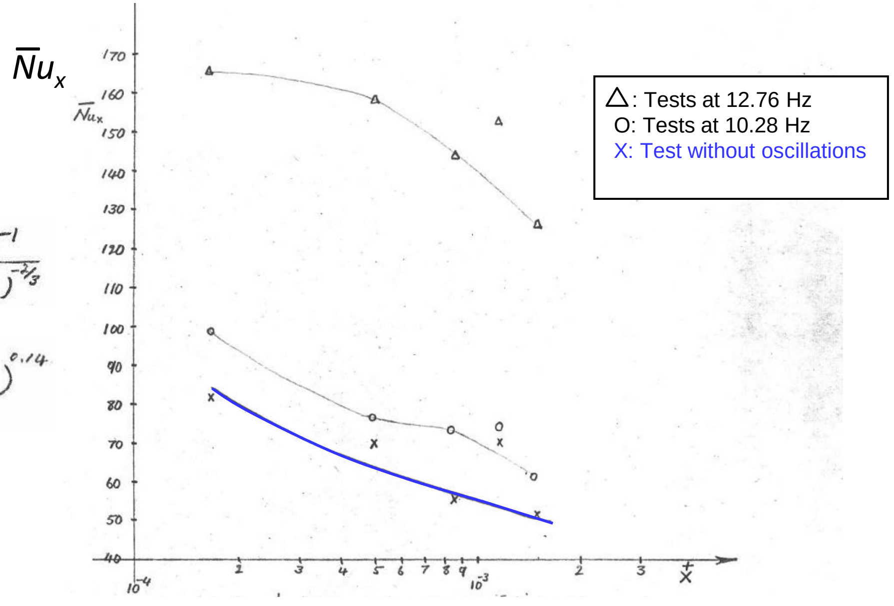
$$\overline{Nu}_x = 3.66 + \frac{0.0668\,(X^+)^{-1}}{1+0.04\,(X^+)^{-2/3}}$$

Formula B (8-63 of textbook)

$$\overline{Nu}_x = 1.86\,(X^+)^{-1/3}\left(\frac{\mu}{\mu_w}\right)^{0.14}$$

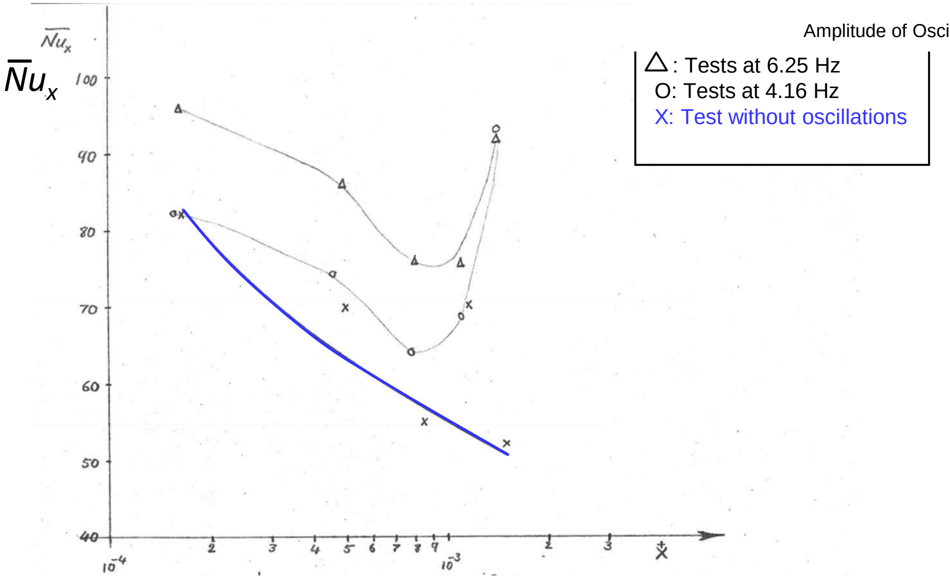
X^+ = [1/ (Re Pr)] x/D

(B-1)
Comparison of experimental data with empirical equations (without Oscillations)



X^+ = [1/ (Re Pr)] x/D

(B-2)
Amplitude of Oscillation was 5 mm (with Oscillations)



X^+ = [1/ (Re Pr)] x/D

(B-3)
Amplitude of Oscillation was 10 mm (with Oscillations)

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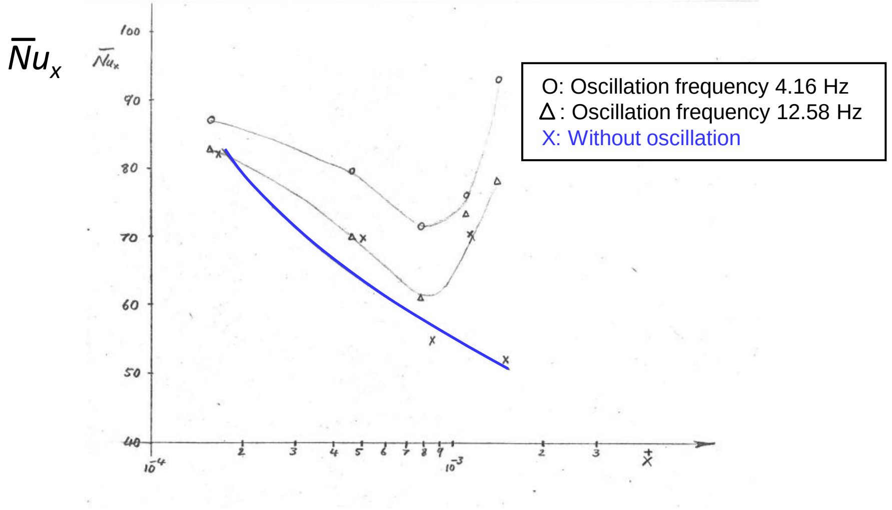
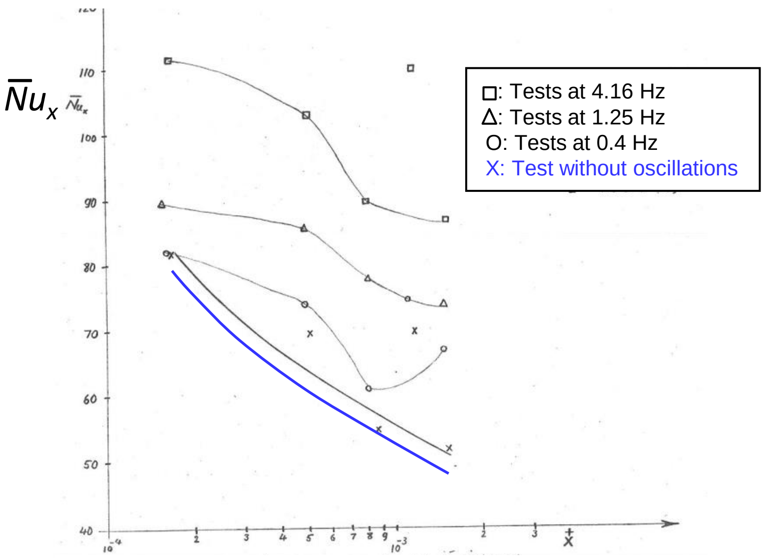


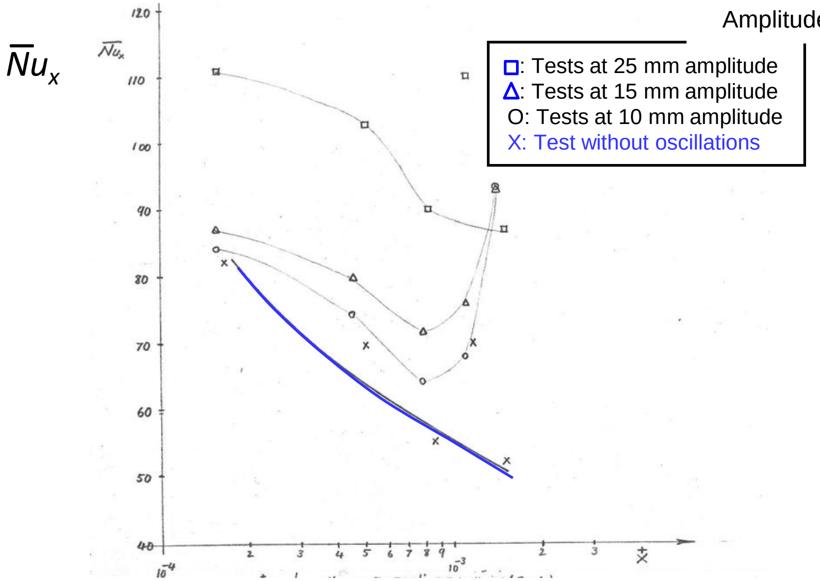
X^+ = [1/ (Re Pr)] x/D

(B-4)
Amplitude of Oscillation was 15 mm (with Oscillations)



X^+ = [1/ (Re Pr)] x/D

(B-5)
Amplitude of Oscillation was 125 mm (with Oscillations)



X^+ = [1/ (Re Pr)] x/D

(B-6)
Frequency of Oscillation was 4.16 Hz (with Oscillations)

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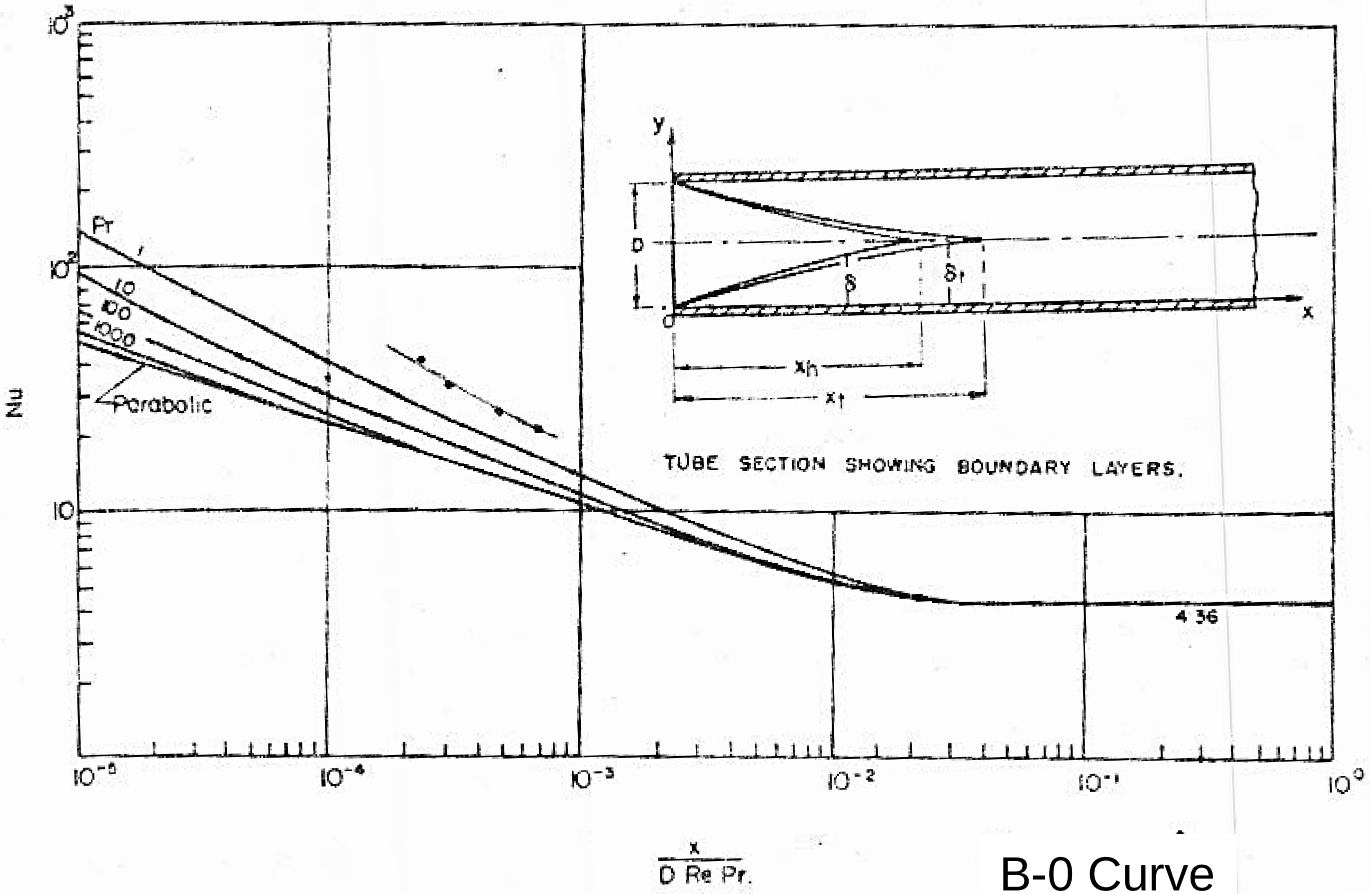

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Journal of Heat Transfer, p. 425, August, 1965

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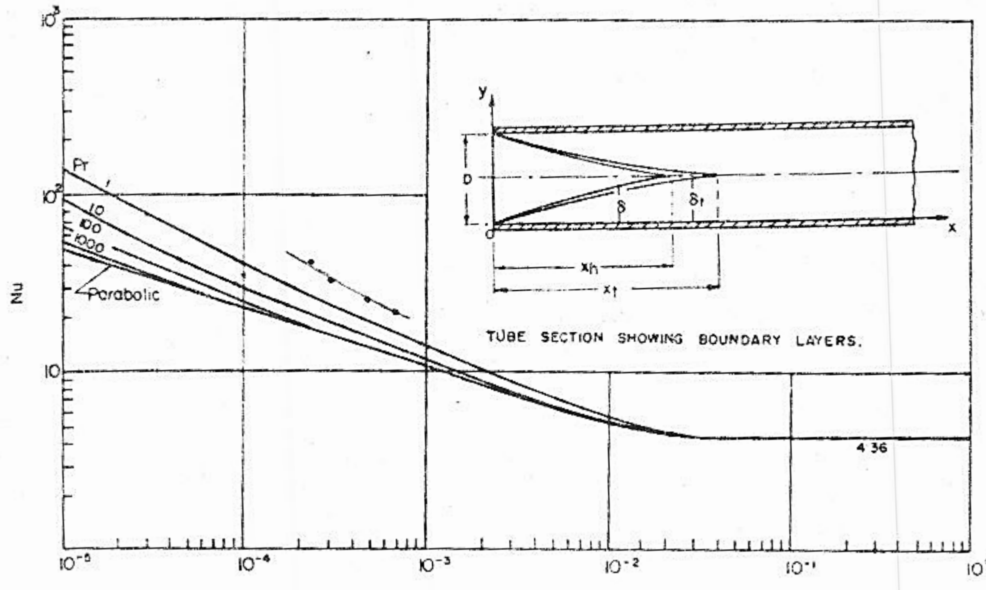

$\frac{x}{D\,\mathrm{Re}\,\mathrm{Pr}}$

Fig. 1

B-0 Curve