NASA TECH BRIEF

Marshall Space Flight Center

Pressure Drop and Pumping Power for Fluid Flow Through Round Tubes

The problem:

To calculate the pressure drop and fluid pumping power for flow through round tubes.

The solution:

A program has been written for the Hewlett Packard 9100A electronic desk type computer which provides a convenient and immediate solution to the problem.

How it's done:

The equations used in the solution are taken from the following manual: Jelinek, D., Active Temperature Control Fluid Systems Preliminary Design for Grand Tour Mission, Rockwell International Corporation, April 1971.

$$\Delta p = 9.7634 \times 10^{-8} \left(\frac{\mu_H}{\rho}\right)\left(\frac{L}{d_i^4}\right)W$$

$$P_W = 3.7660 \times 10^{-4} \left(\frac{\Delta p}{\rho}\right) W$$

where:

d_i = inside tube diameter, ft.

L = tube length, ft.

P_W = pumping power, watts

W = fluid flow rate, lb/hr

Δp = pressure drop, lb/ft^2

ρ = fluid density, lb/ft^3

μ_H = viscosity, lb/(ft x hr)

The program was designed specifically for steady-state analysis and assumes laminar flow.

Notes:

1. This program is written for the Hewlett Packard 9100A electronic desk computer. The documentation includes a program listing; no source deck is required.
2. Potential uses of this program include the design of air duct systems, hot water or steam lines, refrigeration system lines, and hydraulic system lines for use in homes, factories, or automobiles.
3. Requests for further information should be directed to:

   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: MFS-24172

Source: Donald Jelinek of
Rockwell International Corp.
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