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LABORATORY PRESSURE DROP DATA FOR SUPPORT CHARGES USING PIERCED-SOLID DUMMY SLUGS - ALL REACTORS

E. D. Waters

INTRODUCTION AND PURPOSE

This report presents Hydraulics Laboratory data of the pressure drop characteristics for various combinations of 'pierced-solid' dummy slugs in the support charges in the three normal reactor process tubes. 'Pierced-solid' slugs are regular solid aluminum dummy slugs which have been concentrically drilled so that mating against an I & E slug would not block the hole flow channel.

SUMMARY

Dummy section pressure drop comparisons are presented on Figures 1, 2, and 3 for K, BDF, and C reactors, respectively. 'Pierced-solid aluminum dummy slugs (1.438" O.D. by 0.51" I.D. by 8" long) were used in various combinations to produce an increased pressure drop across the dummy charge. No operating peculiarities were observed while using 'pierced-solids' in the support charge.

DISCUSSION OF RESULTS

Tests were conducted using standard process tubes and outlet assemblies. Data were first obtained for standard downstream dummy (support) charges consisting of the following pieces front to rear:

K	BDF and C
3 - 8" expendable perfs	3 - 8" expendable perfs
9 - 8" tubulars	9 - 8" tubulars
2 - 5" expendable perfs	1 - 5" expendable perf
	2 - 8" expendable perfs

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(In the actual tests, the total length of the tubulars was adjusted by a few inches in order to adjust the uranium-to-dummy junction to fit existing pressure taps. Slight changes of the tubular charge length does not cause a detectable change in pressure drop as determined by previous tests.)

Static pressures were measured at the EOAS (end-of-active-section) and at the RNB (rear nozzle barrel).

Pressure drop data are shown on Figures 1, 2, and 3 for the various combinations of dummy charge. The charge and the water temperature are shown for each curve on the figures. There is no known explanation for the pressure drop being higher with a standard C dummy than for either a BDF or K dummy except that reproducibility of these low ΔP data is known to be poor from one charge to another. The RNB tap on a C rear nozzle is at a point where there is flow past the pressure tap whereas there is no flow past the RNB pressure tap on the K and BDF tubes. The velocity head (due to kinetic energy of the fluid) would amount to about 0.57 psi at 60 gpm for the C tube; applying this correction would help bring the curve for a standard C dummy nearer to the curves for K and BDF, but the C curve would still be slightly higher than expected.

The pressure drop for the various new dummy charge combinations are about what might be expected; K tube gives lowest ΔP with C tube slightly higher and the BDF tube the highest ΔP. For charges where a 'pierced-solid' is against the tubular section, the ΔP curve is unpredictable as shown on Figure 1 by +. A 'pierced-solid' at the downstream end of the tubulars showed data near curve E in one case and when recharged at a different time showed data near curve D. This is not surprising, however, since some degree of interjunction flow is involved. It has been demonstrated in I & E slug plugging studies that interjunction flow is quite unpredictable.

Figure 4 illustrates two special effects which were investigated. Curves D and E represent the difference in ΔP when two 'pierced-solid' slugs are separated from each other and from tubulars by first one and then three perfs, respectively, in a C tube.

Comparison of curves A and B for a K tube or curves C and D for a C tube shows the effect of temperature on the dummy section pressure drop. The temperature effect would be about the same for the BDF tube. For the case of a standard dummy charge, the ΔP is about 1 psi less (at 50 gpm) for hot (110°C) than for cold (15°C) water flow.

E.D. Waters, Engineer
Thermal Hydraulics Operation
HANFORD LABORATORIES OPERATION

ED Waters:sjl

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Dummy Section Pressure Drop K Tube

Basis: I & M Briggs-Cold Isothermal Flow

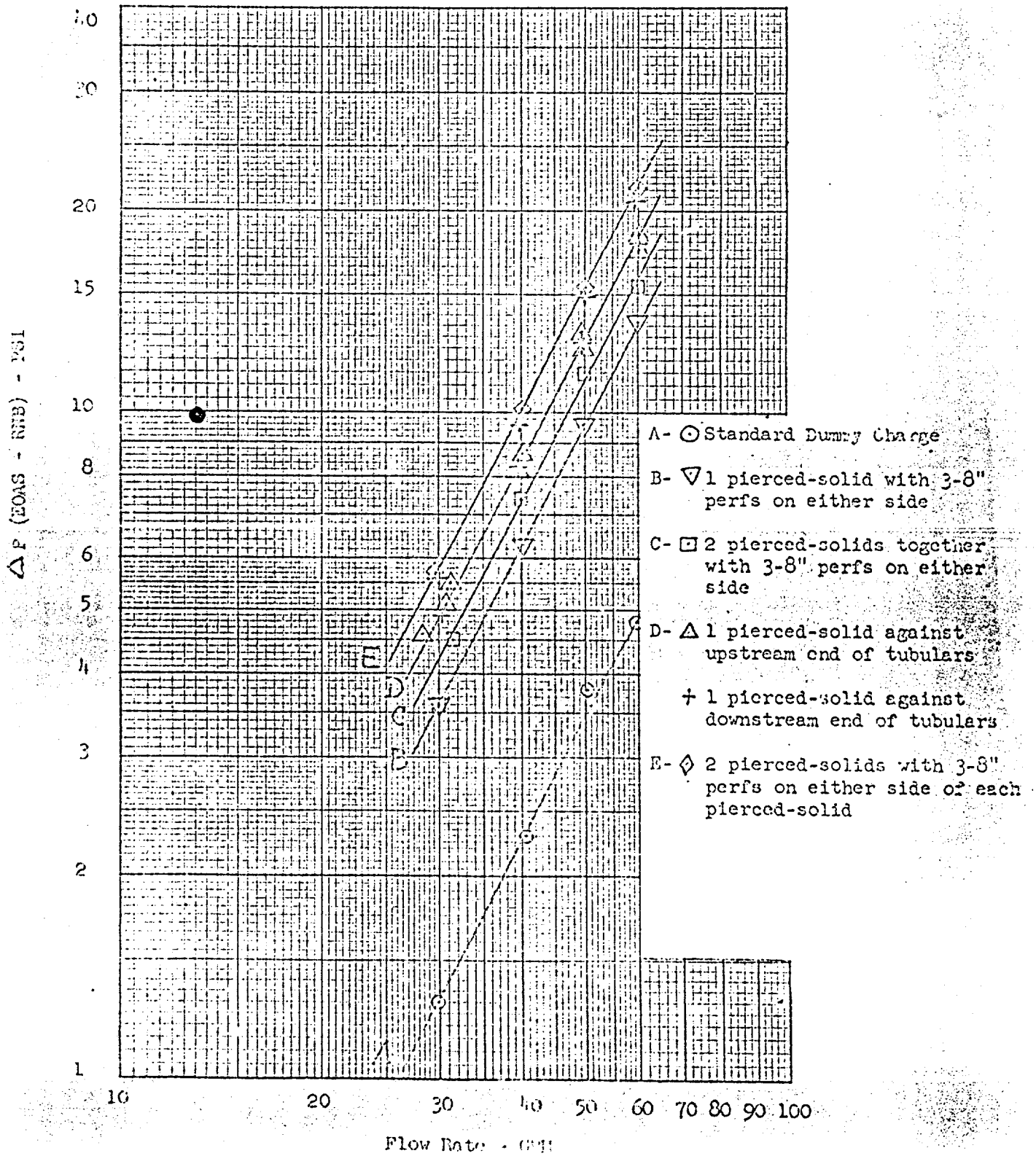

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Figure 2

Dummy Section Pressure Drop RDF Tube

Basis: I & E Slugs-Cold Isothermal Flow

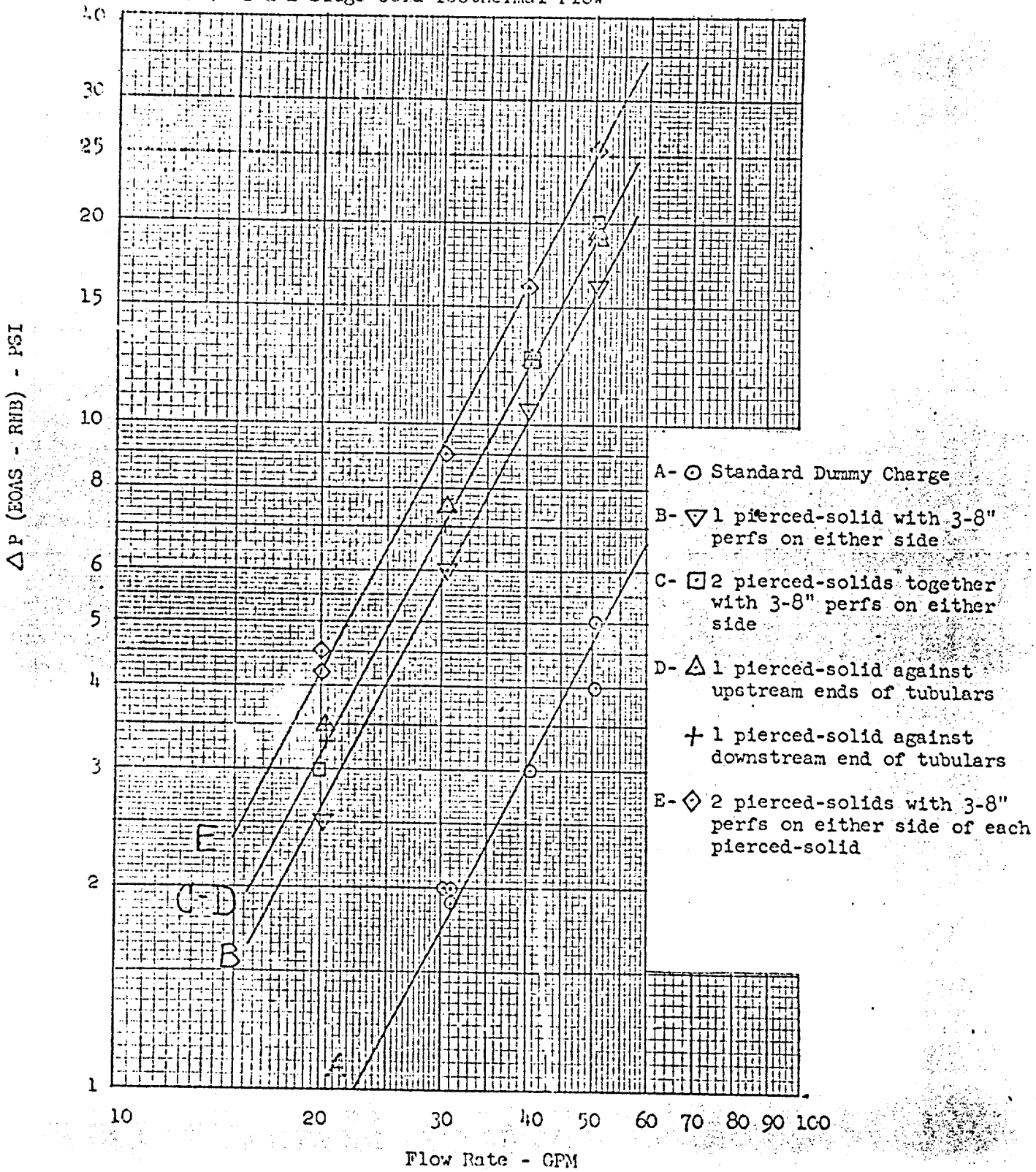

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Figure 3

Dummy Section Pressure Drop C Tube

Basis: I & E Slugs-Cold Isothermal Flow

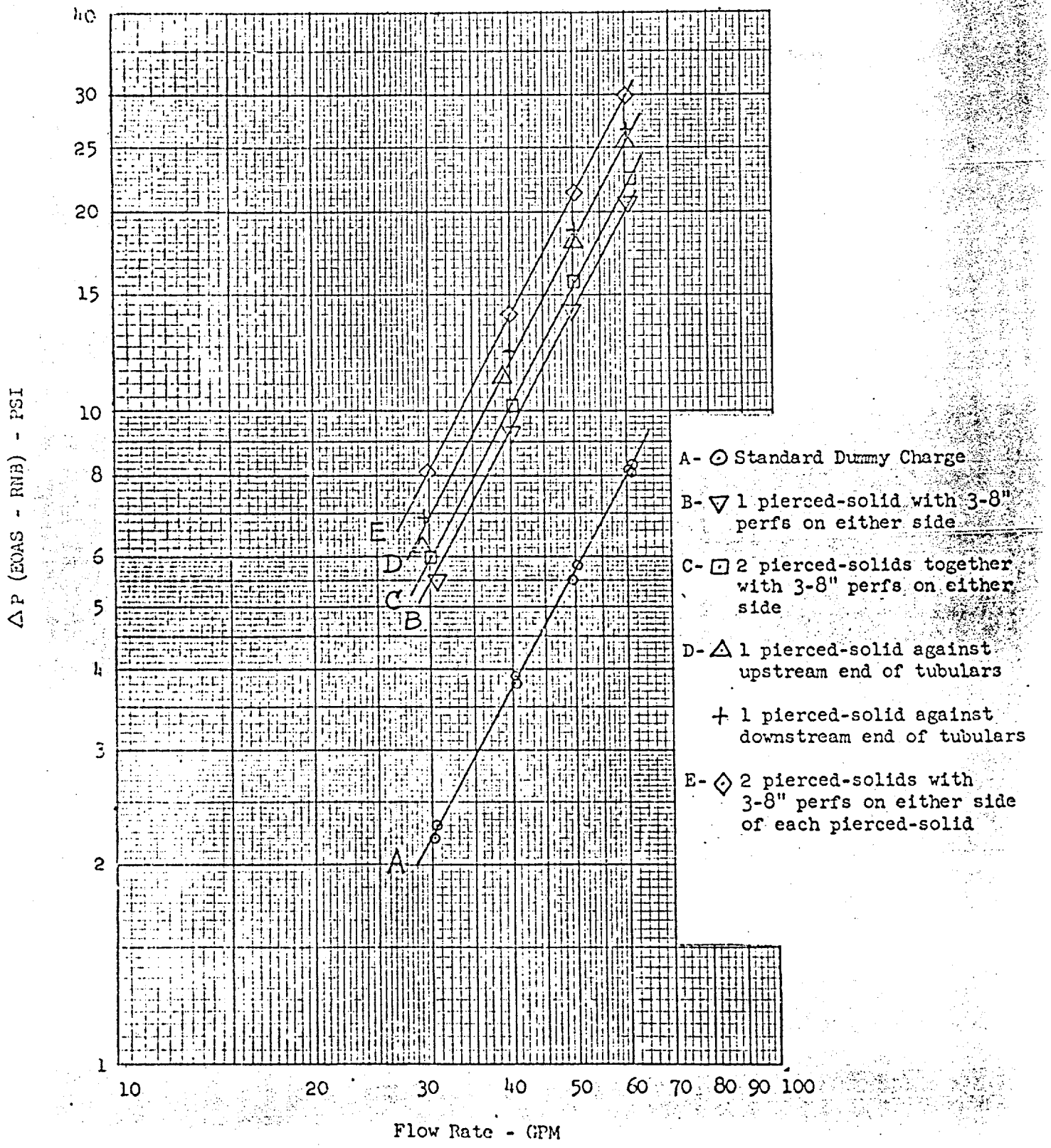

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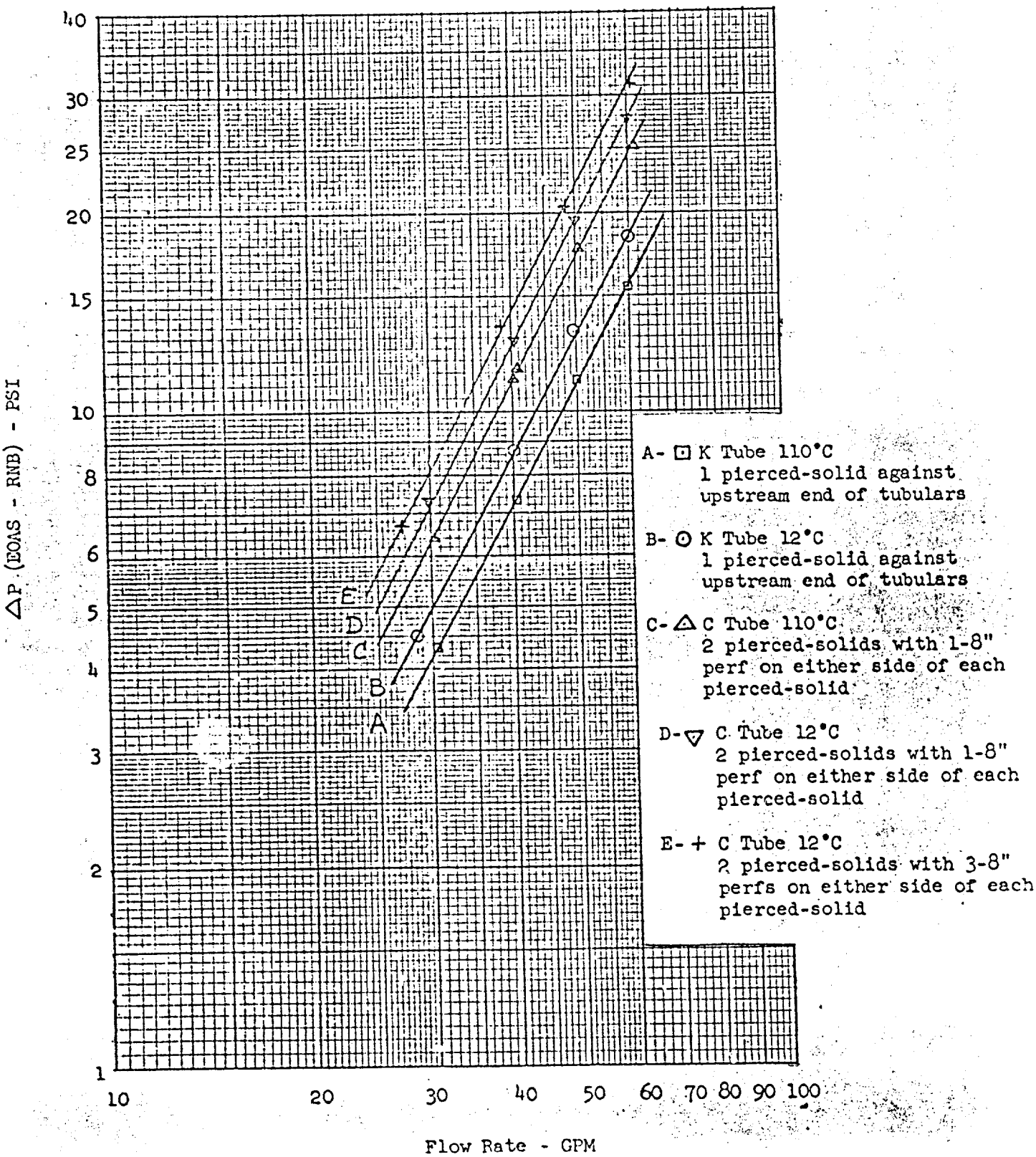
Figure 4

Special Effects



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