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TITLE

HYDRAULIC TESTS OF SPLINE INSERT
MODIFICATIONS - K REACTOR

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-1-

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HYDRAULIC TESTS OF SPLINE INSERT MODIFICATIONS - K REACTOR

Flow tests were conducted in the 189-D Hydraulics Laboratory to determine the effect of certain geometrical variations of the spline cap insert and the nozzle on the pressure losses across the front nozzle portion of a K reactor poison spline tube. The results of these tests are presented in Figures 1 and 2, herein. Since the various designs and modifications originated in your office and since your people supplied the prototypes for flow testing, I can only give a general rather than a dimensional description of the prototypes which were used.

Effect of Spline Cap Insert Shape

Two different shapes of spline cap insert were tested: (1) a standard or blunt shape insert, and (2) a tapered insert. The results of tests of these two shapes are shown in Figure 1. The data in this figure represent the pressure recovery from the Panellit pressure tap to a pressure tap (EOAS) located several feet downstream of the front nozzle. (Since the different shaped inserts resulted in different flow areas at the front nozzle, it was necessary to have the downstream pressure tap away from the nozzle to eliminate velocity effects on the pressure drop readings.) The tapered spline cap insert showed the largest pressure drop recovery; this indicates that there is less energy loss associated with flow through this assembly.

Effect of Nozzle Geometry

The data of Figure 1 were all obtained with an extruded type front nozzle with a perforated plate (1-1/4" blank area) over the nozzle inlet port. The

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-2-

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effect of the nozzle geometry was also investigated and the results are presented in Figure 2. The data in this figure are for pressure recovery from Panellit tap to front nozzle. The pressure recovery for the different geometrical variations of the nozzle assembly can be compared to that for the standard K nozzle (i.e. the original nozzles installed and used on K reactors). First, an extruded nozzle with a full perf plate results in a ΔP the same as a standard nozzle--about 97 psi at 60 gpm. Second, two different annulus thicknesses between the perf plate and the nozzle casting were tested and showed no detectable difference in ΔP . Then different perf plate inserts were tested to determine the effect of leaving the lower portion of the perf plate free of perforations to prevent water from impinging directly on the poison spline. An one half inch width of no-hole area caused a decrease of about 7 psi in pressure recovery while a 1-1/4 inch width of no-hole area caused a decrease of about 13 psi in pressure recovery. Finally, a CG-558 pigtail was used to introduce the flow at the top of the nozzle through an auxiliary inlet port, and it was determined that the ΔP recovery could be improved about 8 psi from the standard K nozzle case. This arrangement with the CG-558 pigtail was with a 1-1/4 inch wide no hole area in the lower part of the perf plate to protect the spline.

For reference purposes, the standard (blunt) insert and the tapered insert are shown pictorially in HW-77073, page 4, and the extruded type inlet nozzle is shown on drawing H-1-33956. All data presented herein were obtained with a 0.419-inch standard K venturi.

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Figure 1

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Figure 2