6D HPCF Analysis Outlines

6D.1 Introduction

This appendix provides procedure outlines of suggested methods to perform inspections, tests, analyses and confirmations of the High Pressure Core Flooder (HPCF) System. These outlines use test data, plant geometry, and analyses to confirm requirements when the reactor is pressurized.

6D.2 Outline for Injection Flow Confirmation

Injection flow has two parts. The first is for the high pressure injection flow (182 m^3/h), and the second is for the low pressure injection flow (727 m^3/h).

6D.2.1 Input Data

HPCF System functional tests shall be performed on the high pressure flooder mode. Analysis shall be performed to convert the test results to the conditions of the design commitment. This analysis will be based upon:

- loop flow and pump discharge and suction pressure data from the flooder mode with the reactor at atmospheric pressure.
- plant as-built dimensional data from suppression pool surface level to RPV normal water level.
- supplier provided pump performance data.

6D.2.2 Preliminary

Determine the elevation distance between the suppression pool (S/P) water level and the RPV's normal water level. Call this the static head (Hs). See Figure 6D-1 for illustration.

Prepare the plant equipment related to each HPCF loop for a flow test from the S/P into the RPV. The RPV head could be on or off for these tests. The following described test-analysis plan is applicable to the two HPCF loops.

Perform a flow test from the suppression pool into the RPV; this is the flooder line. Measure the flow rate, Q1, with the HPCF flow element and the pressure head across the pump, H1, as the difference between the HPCF pump suction to pump outlet. Q1 will be greater than 727 m^3/h.

6D.2.3 High Pressure Injection Flow

Analysis: Determine the hydraulic head loss, $H_{182,}$ for the flooder line for the high pressure flowrate, 182 m^3/h, from the head to flow-squared relationship as follows:

$$H_{182} = (H1 - Hs)(182/Q1)^2$$

Using the vendor supplied pump head-capacity test curve, determine the pressure head across the pump, $P_{182,}$ at the high pressure flow rate of 182 m^3/h.

Confirmation: (Convert all terms to consistent units)

$$P_{182} = H_{182} + Hs + 8.12 \text{ MPa} + \text{margin}$$

6D.2.4 Low Pressure Injection Flow

Analysis: Determine the hydraulic head loss for the flooder line at 727 m^3/h, H_{727}, from the head to flow-squared relationship as follows:

$$H_{727} = (H1 - Hs)(727/Q1)^2$$

Using the vendor supplied pump head-capacity test curve, determine the pressure head across the pump, P_{727}, at a flow rate equal to 727 m^3/h.

Confirmation: (Convert all terms to consistent units)

$$P_{727} = H_{727} + Hs + 0.69 \text{ MPa} + \text{margin}$$

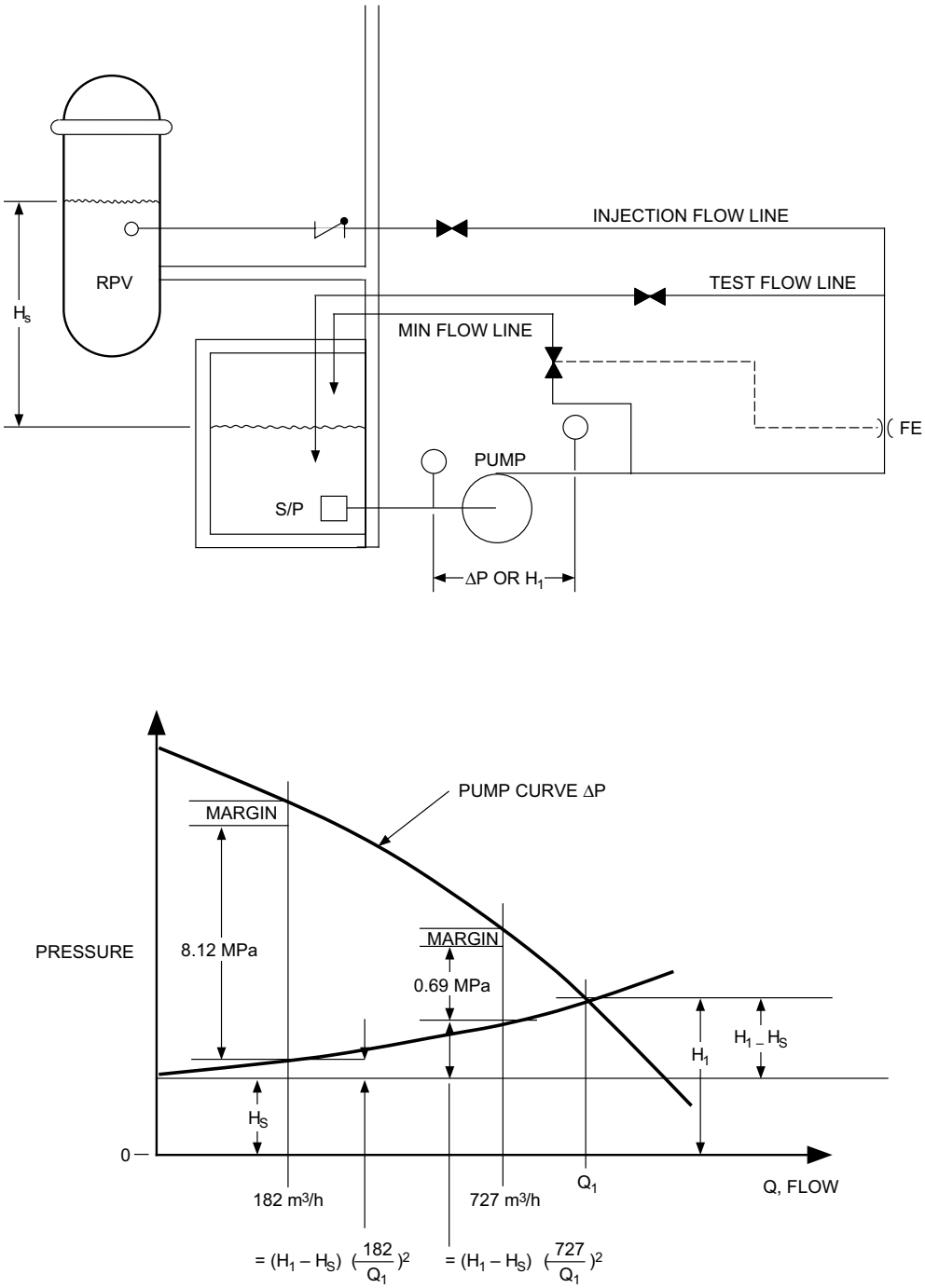

Figure 6D-1 Injection Flow