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SUBJECT: Failure of Let-Down Valve in Slurry Blanket Test

TO: Distribution

FROM: L. F. Parsly

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Summary

The slurry blanket test let-down valve failed after 50 cycles and a total flow time of about 27 minutes in 500 g Th/kg H₂O slurry. The valve is a conventional control valve with stellite trim. The failure was due to erosion of a limited area of the seat and poppet.

Discussion

In the slurry blanket test, the system is so designed that the operating level is normally held within ± 6 inches of an arbitrarily determined normal operating level. Therefore it is necessary to let down slurry to maintain level whenever the system is heated. In the initial design of the system it was decided to see what success could be had with a conventional control valve for this purpose.

The valve selected was a 1/2-inch Annin Model 3461 CF angle type control valve. The flow coefficient (C_v) for this service was 0.063. An outline drawing of the valve is shown in Fig. 1.

The valve was installed in an almost horizontal position (actually slightly below due to the pitch of the lines), with the pressure under the seat. Connecting line sizes are such that essentially all of the system pressure is dissipated in flow through the valve.

Prior to the slurry run, the valve was used successfully during several preliminary water shakedown. No record was kept of the actual number of cycles or of the flow time with water.

On the slurry run, complete records were kept and these are reproduced in Table I. The valve was cycled 50 times before it was found to be leaking. The time open varied from 2 seconds to 10 minutes; the total flow life was approximately 27 minutes.

When the valve was disassembled and examined, the poppet and seat were found eroded on one side. Some erosion also occurred near the tip of the poppet. Fig. 2 and 3 show the wear observed. The type wear observed in the seat area is similar to that which has been found in testing other valves for slurry service. However the service life is the shortest which has been experienced to date. Three possible causes for the attack may be postulated:

- a. Slurry was trapped in the seat, leaving it partially open.
- b. Due to the position in which the valve was mounted, the poppet did not align properly with the seat.
- c. Wear from the slurry during periods when the valve was open may be the sole cause.

The service life of this set of valve trim is substantially less than can be considered acceptable for the present application.

TABLE I
OPERATING HISTORY OF LET-DOWN VALVE

<u>Cycle No.</u>	<u>Date</u>	<u>Time</u>	<u>Time Valve Open, Sec.</u>	<u>System Pressure-psi</u>
1	7-20	2145	60	--
2	7-21	0015	60	--
3	7-21	0045	45	--
4	7-21	0320	15	--
5	7-21	1430	600	350
6	7-21	2300	120	1500
7	7-22	1115	45	1800
8	7-22	1240	15	1800
9	7-22	1243	15	1850
10	7-22	1248	15	1900
11	7-22	1252	15	1900
12	7-22	1303	5	1920
13	7-22	1304	5	1920
14	7-22	1306	5	1900
15	7-22	1309	5	1900
16	7-22	1312	5	1925
17	7-22	1315	5	1880
18	7-22	1326	5	1925
19	7-23	0930	5	2000
20	7-23	0945	5	1950
21	7-23	1000	5	1940
22	7-23	1020	5	1910
23	7-23	1030	5	1910
24	7-23	1040	5	1980
25	7-23	1045	5	1900
26	7-23	1050	5	1910
27	7-23	1055	5	1940
28	7-23	1100	5	1920
29	7-23	1105	5	1950
30	7-23	1110	5	1920

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TABLE I (continued)

<u>Cycle No.</u>	<u>Date</u>	<u>Time</u>	<u>Time Valve Open, Sec.</u>	<u>System Pressure-psi</u>
31	7-23	1115	5	1920
32	7-23	1125	7	1890
33	7-23	1140	2	1840
34	7-23	1418	5	2010
35	7-23	1425	5	1910
36	7-23	1435	5	1910
37	7-24	1120	10	1780
38	7-24	1325	10	1800
39	7-24	1335	10	1800
40	7-24	1345	10	1800
41	7-24	1350	10	1800
42	7-26	1400	60	1800
43	7-26	1405	180	1800
44	7-27	1258	600	1800*
45	7-27	2305	10	300
46	7-27	2325	20	300
47	7-28	0000	60	500
48	7-28	0005	40	450
49	7-28	0210	60	700
50	7-28	0215	30	600

* Dumped loop completely through the let-down valve.

Fig. 1. Outline of 1/2 inch Annin Model 3461 Control Valve.

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