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**Investigation on the Degradation Mechanism of 6" Swing Check Valve for Nuclear Power Plant**

103- 16

216

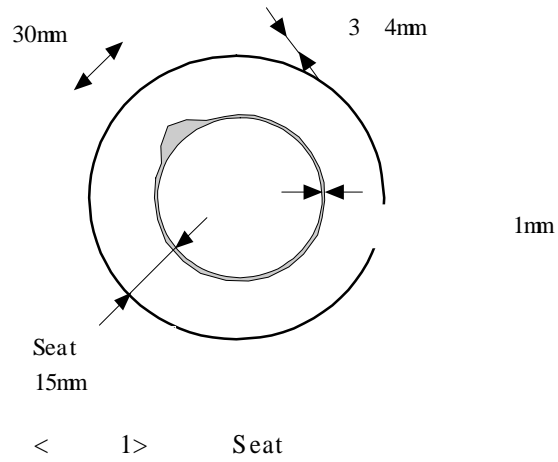
O/H 6" swing check valve seat  
chattering

**Abstract**

Degradation occurred at the 6 inch swing check valve in nuclear power plant. Valve replacement and maintenance were carried out during the plant O/H. This report examined the degradation mechanism of the 6 inch check valve by the experimental and theoretical study. Results shows that the degradation was caused by valve chattering which due to the structural and acoustic resonance.

1.

O/H 6" swing check valve seat  
1 seat 15mm  
disc 2mm ) seat disc seat 13mm ( , seat



2. 6"

가 V059 가 V055 V060 가 ( 6 )

2 0 330 가 278Hz (z) 7) 170 300 330 (mm/sec), 가 (Hz) 가 170 , 300 , 33 0.034mm/sec, 0.34mm/sec, 0.68mm/sec 6" 1190rpm,

$$f_n = \frac{n \times rpm \times z}{60} = \frac{n \times 1190 \times 7}{60} = n \times 139Hz \quad (1)$$

3.

6" chattering chattering (1) chattering, (2)

chattering, (3)

vortex

chattering

3-1.

chattering

139Hz(1 )

278Hz(2 ), 417Hz(3 ),

...

가

3

가 ,

2

(Hz)

(mm/sec)

(a) (f)

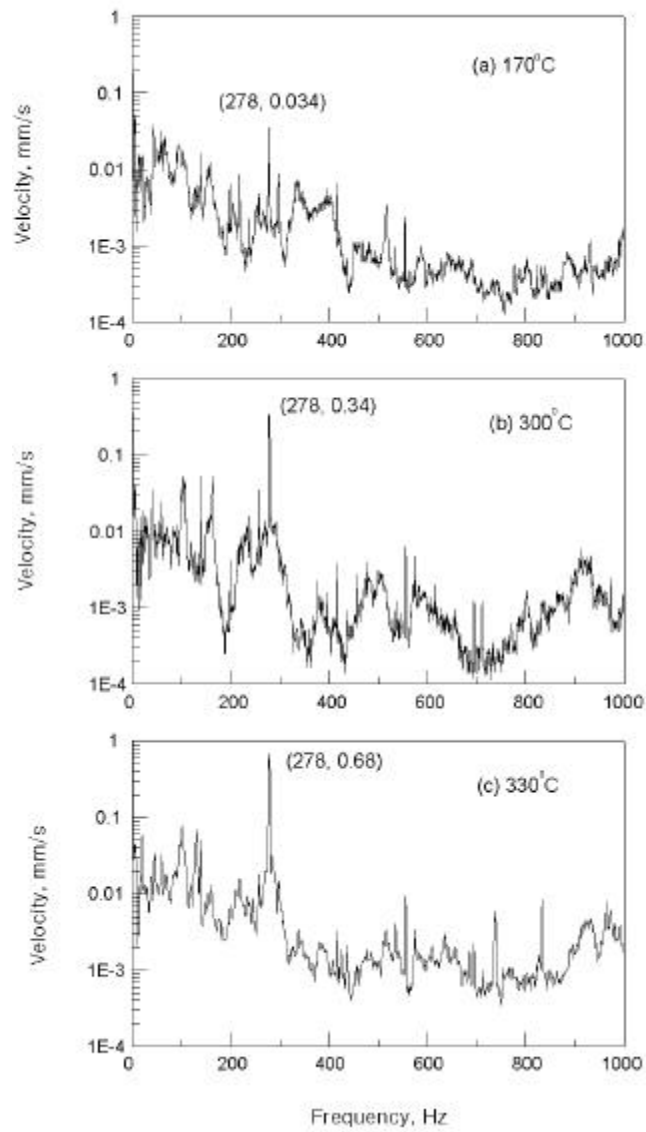
가

100Hz

가

278Hz

가



ANSYS

1 2  
 278Hz가 1 가  
 21 282Hz  
 21  
 21 282Hz가  
 (278Hz) (282Hz)  
 가

< 1 >

Mode	Frequency (Hz)	Mode	Frequency (Hz)
1	8.4	14	129.4
2	23.5	15	179.3
3	31.7	16	188.4
4	31.8	17	216.8
5	36.8	18	240.2
6	44.2	19	245.8
7	64.3	20	252.3
8	74.8	<b>21</b>	<b>281.8</b>
9	82.6	22	376.9
10	88.9	23	434.1
11	105.0	24	445.7
12	108.9	25	473.9
13	110.3		

3-2.

chattering

139Hz(1 )

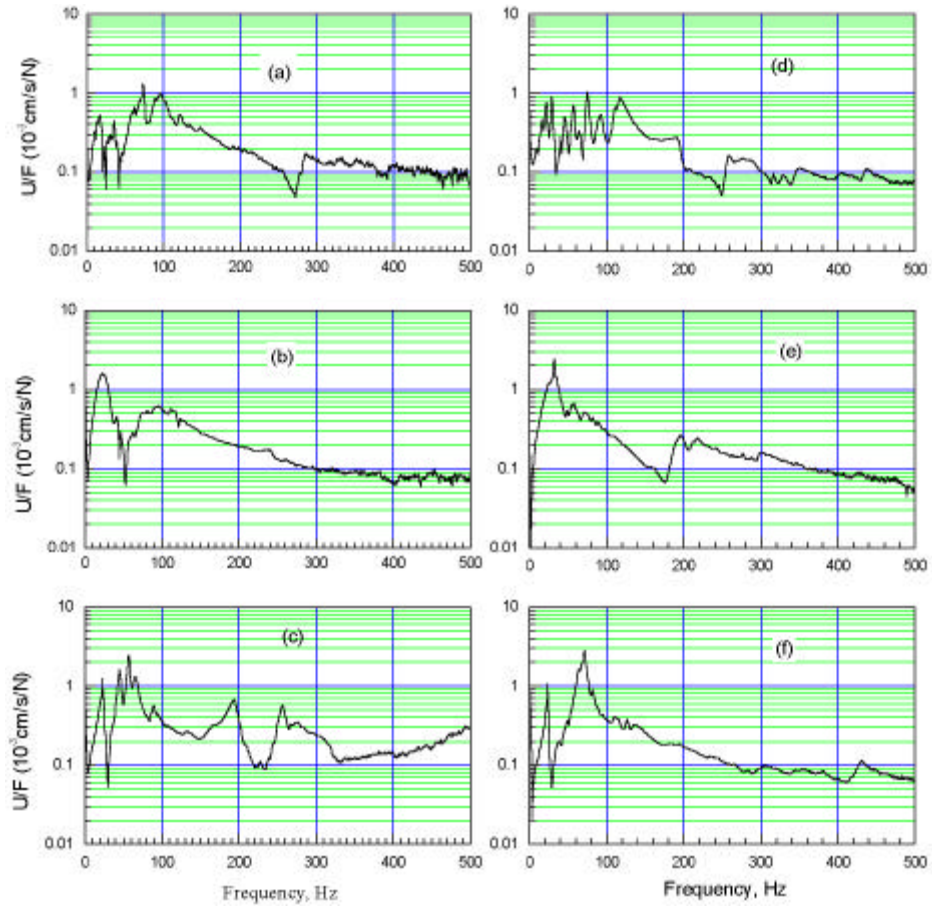
(278Hz(2 ), 417Hz(3 ), ...)

2 278Hz가

$$f_n = \frac{na}{2L} \quad (2)$$

, a : , L :

가  
 가 (EPRI TR-107455 )  
 가  
 가  
 chattering chattering  
 seat disc



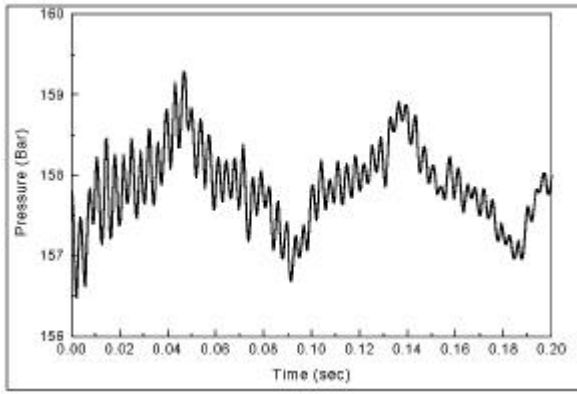
< 3 >

\* (a)V058, (b)V055, (c)V059, (d)V060, (e)V056, (f)V057

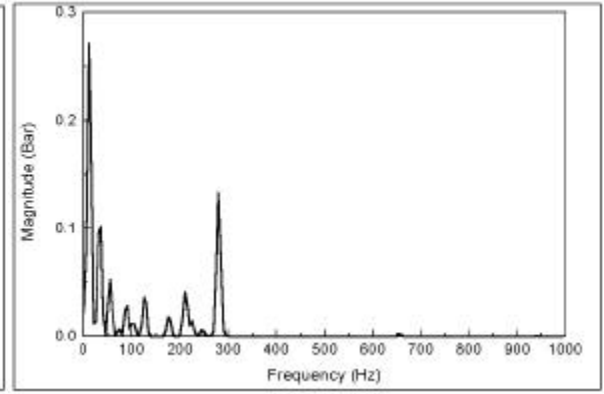
가 AMESim  
 (Advanced Modeling Environment for Simulations of engineering systems) Code  
 (V059) . AMESim Code Code

0.0002 bar 5 139Hz, 157.8 bar



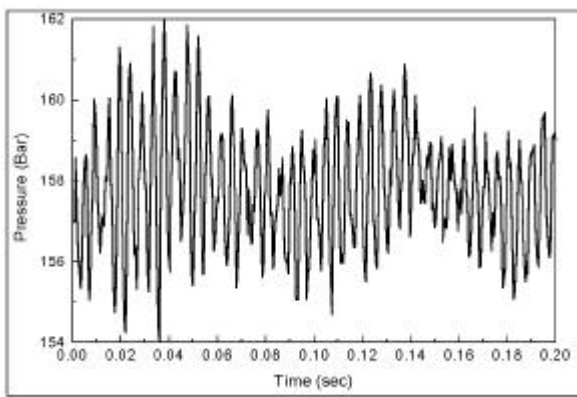


(a)

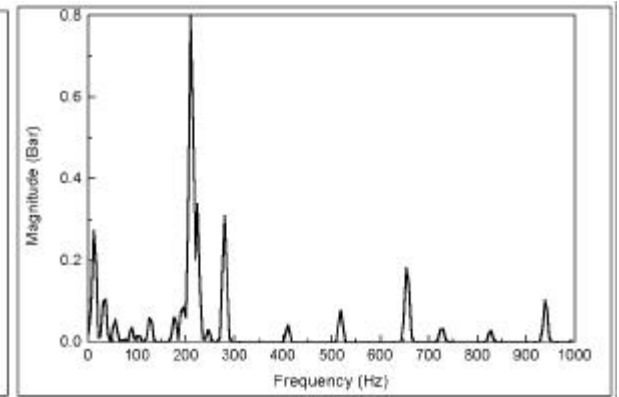


(b)

< 5 > B1



(a)



(b)

< 6 > V059

4 L<sub>1</sub>, L<sub>2</sub>  
7  
V059 , V056  
가 )

V059 V056  
1/2

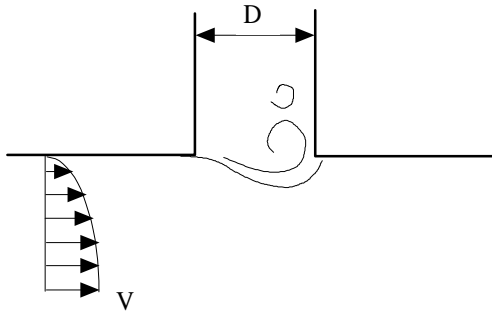
3 L<sub>1</sub>, L<sub>2</sub>  
V059  
(V059 V056  
가 280Hz

< 3 >

Valve	L <sub>1</sub> (inch)	L <sub>2</sub> (inch)
V059	29.5	29.0
V056	37.25	32.0







< 8 > vortex

4.

6"

2가 가

(1)  
chattering

(2)

chattering

(139Hz)

가

disc chattering seat ring disc

5.

가

9

15cm

가 280Hz

274Hz, 288Hz

274Hz( 9(a))

288Hz( 9(b))

1/2

가 280Hz

V057, V058, V059, V060

가

chattering

가

280Hz

280Hz

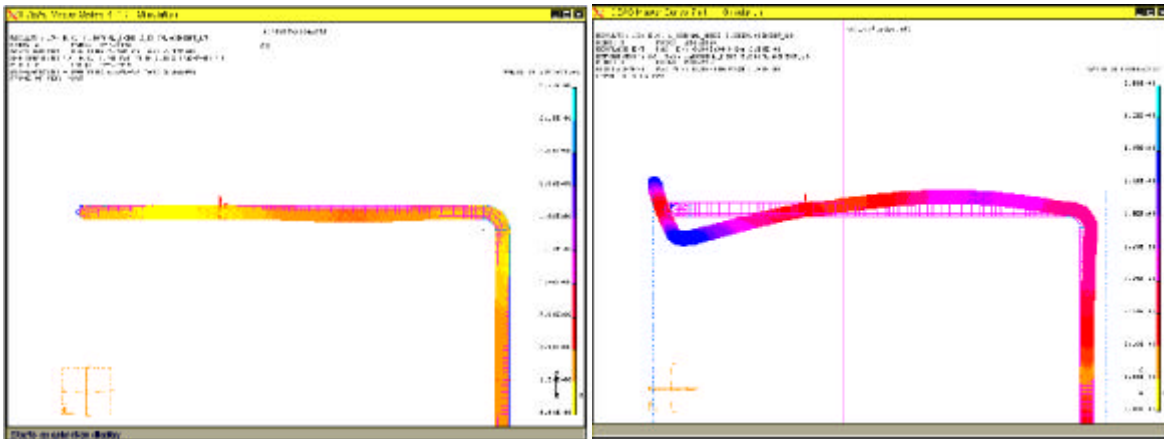
chattering

( ,  
 , 가  
 )  
 ,  
 damping chattering  
 가

6.

6"

chattering



(a) 274 Hz

(b) 288 Hz

< 9> 6"

- [1] "Application Guide for Check Valves in Nuclear Power Plants", EPRI NMAC NP-5479.
- [2] "Valve Application, Maintenance, and Repair Guide", EPRI NMAC TR-105852, December 1996.
- [3] "Vibration Fatigue of Small Bore Socket-Welded Pipe Joints", EPRI TR-107455, June 1997.
- [4] "Boric Acid Corrosion of Carbon and Low-Alloy Steel Pressure-Boundary Components in PWRs", EPRI NP-5985, 1988.
- [5] "Boric Acid Corrosion Guidebook", EPRI TR-104748, 1995.