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SCHWENCER,A Licensing Branch 2

SUBJECT: Forwards responses to items from sont audit on 810819-20.

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Docket Nos. 50-387
50-388

December 29, 1981

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U. S. Nuclear Regulatory Commission
Washington, DC 20555



SUSQUEHANNA STEAM ELECTRIC STATION
NRC SQRT AUDIT OPEN ACTION ITEMS
ER 100450 FILE 148-01
PLA-988

Dear Mr. Schwencer:

Attached are the responses to the following items from the SQRT audit of August 19-20, 1981:

IV(2) For the valves audited, provide confirmation that the acceleration 'g' values used in the qualfication are correspondingly equal to or less than those obtained from the final as-built piping analysis (12/31/81).

IV(3) For Control Panel (J05 A), provide clarification for the following:

(a) Dynamic relationship of the selected (reviewed) panel to the five panels tested and evaluated (12/31/81).

(b) Comparison of the maximum stress of the selected panel with the maximum stress of the five tested panels, and the basis for the evaluation (12/31/81).

IV(4) For Containment Vacuum Relief Valve (M 149) provide clarification for the consideration of the loads at the free end of the downcomer during qualification (12/31/81).

If you have any questions, please contact us.

Very truly yours,

N. W. Curtis
Vice President - Engineering and Construction - Nuclear

Attachment

cc: R. Perch - NRC

B001
S 1/1

## RESPONSE TO NRC QUESTION ITEM #IV (2)

Question:

For the valves audited, provide confirmation that the acceleration 'g' values used in the qualification are correspondingly equal to or less than those obtained from the final as-built piping analysis (12/31/81).

Response:

The valves audited were:

(1) P-12BC - Motor Operated

Qty = 4 F073A, B; F075A, B

(2) P-14BC - Motor Operated

Qty = 1 HV-12603

(3) J-69 - Solenoid Valves

Qty = 4 F025, F026, F028m F029

(4) M-159 - Relief Valves

Qty = 2 PSV-12643, PSV-12648

The following sheets 2 through 4 summarizes the desired confirmation in a tabular form.

ATTACHMENT - 1

SHT. 2 of 5

# SUMMARY OF VALVE ACCELERATION

## CALCULATION NUMBER : 887-1 REV.1

| DATA POINT | VALVE NUMBER | VALVE SIZE | VALVE DWG. NUMBER | SK-M NUMBER REV NO | LINE DESCRIPTION | MAX. VALVE ACCELERATION* ACTUAL (g) | MAX. VALVE ACCELERATION* ALLOW. (g) |
|---|---|---|---|---|---|---|---|
| ~~17~~ | ~~HV-1F003~~ | ~~30"~~ | ~~8856-P12BC-8(3)-10~~ | ~~887/5~~ | ~~20"HPC-113~~ | ~~1.694~~ | ~~3.0~~ |
| 127 | HV-1F073B | 6" | 8856-P12BC-59-5 | ↓ | 6"HPC-113 | 2.937 | 5.07 |
| 147 | HV-1F075B | 6" | 8856-P12BC-47 | | 6"GBB-119 | 3.181 | 7.33 |
| | | | | | | | |
| | | | | | | | |
| | * MAXIMUM IN ANY DIRECTION | | | | | | |
| | | | | | | | |
| | | | | | | | |

ORIGINATOR R.H.E. DATE 6-2-81 CHECKED SMR DATE 6-5-81

PROJECT SUSQUEHANNA UNIT - 1 JOB NO. 8856

SUBJECT SUMMARY OF VALVE ACCELERATION SHEET NO. 5 of 30

CALC. NO.

Attachment #1 Sht. 2 of 5

EP-2078 Rev. (2/78)

ED-09

ATTACHMENT-1



# SUMMARY OF VALVE ACCELERATION

## CALCULATION NUMBER : 893-1 REV. 1

| DATA POINT | VALVE NUMBER | VALVE SIZE | VALVE DWG. NUMBER | SK-M NUMBER REV NO. | LINE DESCRIPTION | MAX. VALVE* ACCELERATION ACTUAL (g) | MAX. VALVE* ACCELERATION ALLOW. (g) |
|---|---|---|---|---|---|---|---|
| ~~117~~ | ~~HV-1F010A~~ | ~~20"~~ | ~~8856-P16-BC-8(1)-12~~ | ~~893/N~~ | ~~20" HRC-112~~ | ~~1.565~~ | ~~3.0~~ |
| 127 | HV-1F073A | 6" | 8856-P12-BC-59-6 | 893/N | 6" HRC-113 | 3.057 | 5.07 |
| 147 | HV-1F079A | 6" | 8856-P12-BC-47-4 | 893/N | 6" GBB-119 | 2.856 | 7.33 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

* MAXIMUM IN ANY DIRECTION

Attachment #1 Sheet 3 of 5

ORIGINATOR I E JUGON DATE 5-21-81 CALC. NO. 893-1 REV. NO. 1

PROJECT SUSQUEHANNA UNIT - 1 CHECKED SHR. DATE 5-27-81

SUBJECT SUMMARY OF VALVE ACCELERATION JOB NO. 8856 SHEET NO. 4/34

CALCULATION SHEET

# SUMMARY OF VALVE ACCELERATION

## VALVE QUALIFICATION ACCELERATIONS (SQRT VALVES)

| P&ID | VALVE NUMBER | VALVE SIZE | VALVE VENDOR I.D. | SK-M NUMBER | LINE DESCRIPTION | MAX. VALVE ACCELERATION ACTUAL (g) | MAX. VALVE ACCELERATION ALLOW.* (g) |
|---|---|---|---|---|---|---|---|
| 126 | HV-12603 | 2" | P14BC (MOTOR OPER.) | 6071 | HCB-129 | X: 3.981 Y: 2.905 Z: 5.6 | 8 |
| 149 | HV-E51-1F025 | 1" | J69 (SOLENOID) | 5543 | DBB-109 | X: 4.853 Y: 4.919 Z: 1.404 | 6 |
| 149 | HV-E51-1F026 | 1" | J69 " | 5543 | DBB-109 | X: 4.853 Y: 4.919 Z: 1.404 | 6 |
| 155 | HV-E41-1F028 | 1" | J69 " | 5540 | DBB-114 | X: 4.853 Y: 4.919 Z: 1.404 | 6 |
| 155 | HV-E41-1F029 | 1" | J69 " | 5540 | DBB-114 | X: 4.853 Y: 4.919 Z: 1.404 | 6 |
| 126 | PSV-12643 | 1" | M159 (SRV) | 5471 | HCC-140 | X: 4.853 Y: 4.919 Z: 1.404 | 52 ** |
| 126 | PSV-12648 | 1" | M159 (") | 5428 | HCC-139 | X: 4.853 Y: 4.919 Z: 1.404 | 52 ** |
| | | | | | | | |

Attachment #1 Sheet 4 of 5

* PER SQRT DOCUMENTATION

** SEE ATTACHED GRAPH

CALCULATION SHEET

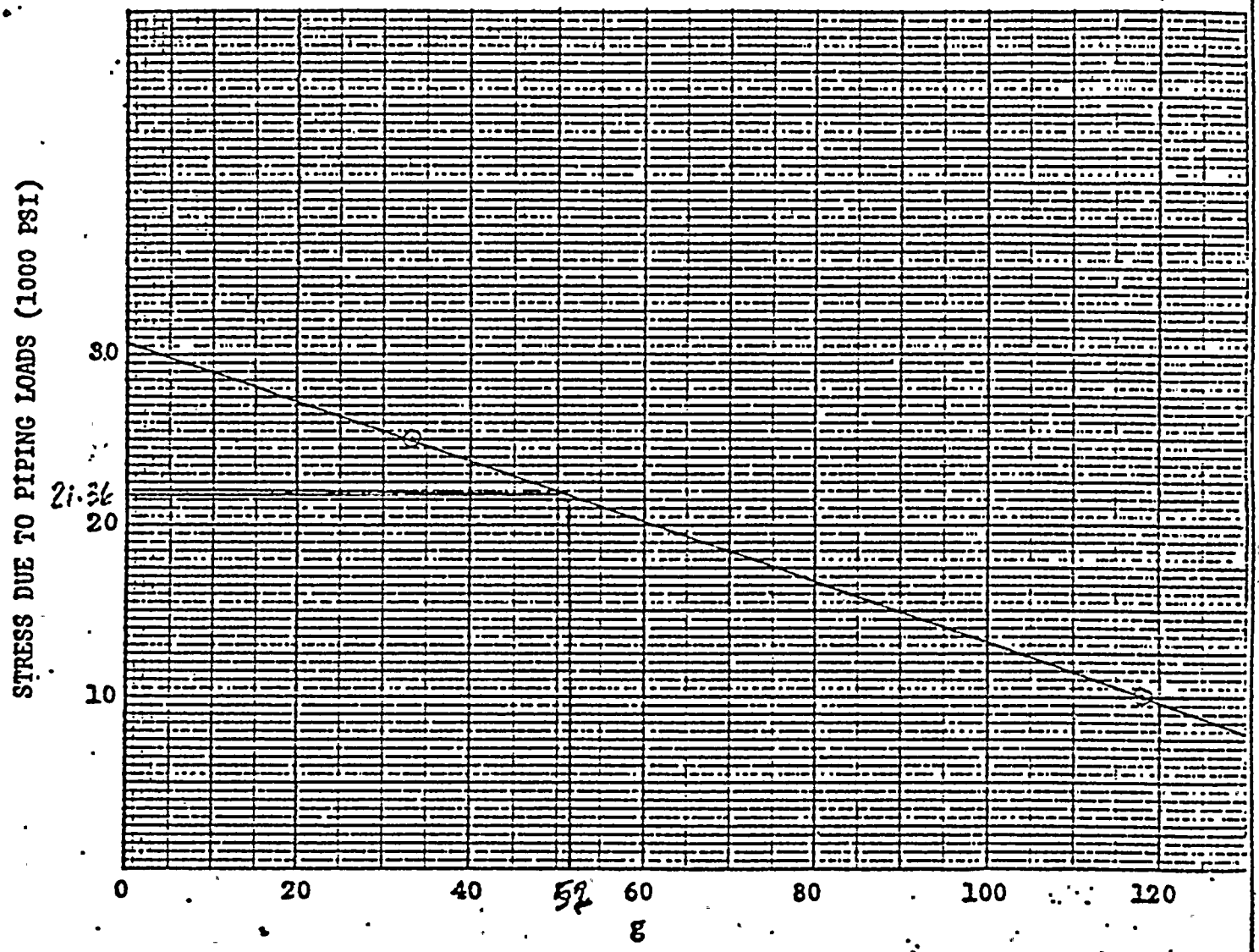
ORIGINATOR SHAIL CHOKHAVATIA DATE 12/11/81 CHECKED DATE

PROJECT SUSQUEHANNA UNIT-1 JOB NO. 8856

SUBJECT SUMMARY OF VALVE ACCELERATION SHEET NO.

CALC. NO. REV. NO.

## SEISMIC CALCULATIONS




Z = 2.75 IN

S = .133 IN³

PSV-12643
PSV-12648

1X1

## RESPONSE TO NRC QUESTION ITEM #IV (3)

Question:

For Control Panel (J-05A), provide clarification for the following:

(a) Dynamic relationship of the selected (reviewed) panel to the five panels tested and evaluated (12/31/81).

(b) Comparison of the maximum stress of the selected panel with the maximum stress of the five tested panels, and the basis for the evaluation (12/31/81).

Response:

(3a) Five panels were selected to get the best representation of the population of 49 panels.

(1) To include the various elevation and the corresponding floor response spectra.

(2) To include the various sizes and the weights to get the highest weight per linear ft. to yield the highest response.

(3) To include the characteristics due to the mounting conditions at the base such as concrete floor support or the steel base mounting.

(4) To include the characteristics of the local mounting panels.

Analysis of these panels identified the necessity to do the following fixes to assure that the structural characteristics of the panels produce acceptable responses in terms of (a) structural integrity of the panels and (b) the response spectra for component qualifications.

1. Stiffen mounting panels.

2. Stiffen panel where instrument is directly mounted on the skin.

3. Stiffen center plate free edge.

4. Stiffen base channel.

5. Inspect and tighten anchor bolts and add anchor bolts as needed.

All the panels were inspected and field work for the above modifications is presently underway. These modifications will assure that the structural characteristics of all the panels be such that the responses are with in that of the panels that have been analyzed.

(3b) Subsequent to the completion of engineering effort to extrapolate the results of analysis for five selected panels to the remainder 44 panels of P.O. J-05A, J-05B and M-334, two additional panels, namely 1C681 and 0C876A were selected and analyzed. This was done to:

- Verify the stresses and structural integrity of the panels actually not analyzed during initial (April, 1981) analysis. Panel 1C681 was specifically selected by the NRC audit team, for this purpose.
- Verify the representation achieved by the five panels selected initially.
- Verify the adequacy of the fixes.

A review of the results of this additional analysis (see sheet #3 for panel 1C681 and Sheet #4 for panel 0C876A) indicates that, as expected, the stresses in these panels are well below allowables. For ready reference the stresses in the initial five panels are given on sheet #5 through #9. The earlier conclusion that the panel qualification is satisfactory is hereby reaffirmed.

From: Bechtel V.P # 8856-J8-11-1

TABLE 9

SUMMARY OF MAXIMUM STRESSES IN PANEL 1C681

MAXIMUM DISPLACEMENT: .008 INCHES

MAXIMUM ACCELERATION: 1.84g (HORIZONTAL)
0.97g (VERTICAL)



| MAXIMUM STRESSES | | | | |
|---|---|---|---|---|
| PANEL COMPONENT | STRESS TYPE | MAXIMUM VALUE | ALLOWABLE VALUE | MAXIMUM ALLOWABLE |
| (a) MOUNTING PLATES | SHEAR<br>FLEXURE | 135<br>150 | 14400<br>27000 | .009<br>.006 |
| (b) CABINET | | | | |
| SIDES | SHEAR | 112 | 13200 | .008 |
| FRONT | SHEAR<br>FLEXURE | 156<br>331 | 14400<br>27000 | .01<br>.01 |
| (c) WELDS | SHEAR | 1322 | 18000 | .07 |
| (d) ANCHOR BOLTS | COMBINED SHEAR + TENSION | 1476 | 1600 | .92 |
| (e) BRACINGS | COMPRESSION | 19 | 6480 | .003 |

From Bechtel V.P. [redacted]856-J8-11-1

ATTACHMENT - 2
Sht. 4 of 9

TABLE 10

SUMMARY OF MAXIMUM STRESSES IN PANEL OC876A

MAXIMUM DISPLACEMENT: .006 INCHES

MAXIMUM ACCELERATION: 0.91g (HORIZONTAL)
0.74g (VERTICAL)

MAXIMUM STRESSES

| PANEL COMPONENT | STRESS TYPE | MAXIMUM VALUE | ALLOWABLE VALUE | MAXIMUM ALLOWABLE |
|---|---|---|---|---|
| (a) MOUNTING PLATES | | | | |
| | SHEAR | 38 | 14400 | .003 |
| | FLEXURE | 364 | 27000 | .01 |
| (b) CABINET | | | | |
| SIDES | SHEAR | 75 | 13200 | .006 |
| DOOR JAMBS | SHEAR | 58 | 13200 | .004 |
| | FLEXURE | 1407 | 19800 | .07 |
| ANGLE (H FRAME) | SHEAR | 46 | 14400 | .003 |
| | FLEXURE | 1414 | 21600 | .07 |
| (c) WELDS | SHEAR | 802 | 18000 | .04 |
| (d) ANCHOR BOLTS | COMBINED SHEAR + TENSION | 648 | 16000 | .41 |
| (e) BRACINGS | COMPRESSION | 21 | 19900 | .001 |

MAXIMUM DISPLACEMENT: .073 INCHES

MAXIMUM ACCELERATION: 1.065g (VERTICAL)
0.837g (HORIZONTAL)

MAXIMUM STRESSES:

| PANEL COMPONENT | STRESS TYPE | MAXIMUM VALUE | ALLOWABLE VALUE | MAXIMUM / ALLOWABLE |
|---|---|---|---|---|
| (a) MOUNTING PLATES | | | | |
| | SHEAR | 322 | 14400 | .02 |
| | FLEXURE | 916 | 27000 | .04 |
| (b) CABINET | | | | |
| TOP | SHEAR | 24 | 13200 | .002 |
| SIDES | SHEAR | 29 | 13200 | .002 |
| DOOR JAMBS | SHEAR | 99 | 13200 | .008 |
| | FLEXURE | 4182 | 19800 | .21 |
| HATCH JAMBS | SHEAR | 223 | 13200 | .02 |
| | FLEXURE | 488 | 19800 | .03 |
| BOTTOM CHANNELS | SHEAR | 13 | 14400 | .001 |
| | FLEXURE | 263 | 21600 | .012 |
| ANGLE BRACKETS | SHEAR | 157 | 14400 | .01 |
| | FLEXURE | 2739 | 21600 | .13 |
| (c) WELDS | | | | |
| | SHEAR | 2732 (WELD OF MOUNTING) | 18000 | .15 |
| (d) ANCHOR BOLTS | COMBINED SHEAR + TENSION | 445 | 1200 | 0.37 |

TABLE 4.1 SUMMARY OF MAXIMUM STRESSES IN PANEL OC883B

From Bechtel V.P.#8856-J8-4-2

MAXIMUM DISPLACEMENT: .057 inches

MAXIMUM ACCELERATION: 1.868g (horiz)
0.406g (vert)

| MAXIMUM STRESSES: | | | | |
|---|---|---|---|---|
| PANEL COMPONENT | STRESS TYPE | MAXIMUM VALUE | ALLOWABLE VALUE | MAXIMUM ALLOWABLE |
| (a) Mounting Plates | Shear | 510 | 13200 | .04 |
| | Flexure | 566 | 19800 | .03 |
| (b) Cabinet | | | | |
| Sides | Shear | 143 | 13200 | .011 |
| Top | Shear | 1511 | 13200 | .114 |
| Corner Beams | Shear | 194 | 13200 | .015 |
| | Flexure | 3856 | 19800 | .195 |
| Angle on Plate | Shear | 53 | 14400 | .004 |
| | Flexure | 2056 | 21600 | .095 |
| (c) Welds | Shear | 6471 (side plates) | 18000 | .36 |
| (d) Anchor Bolts | Combined shear & Tension | 917 | 2660 | 0.345 |

TABLE 5.1 SUMMARY OF MAXIMUM STRESSES IN PANEL 2C661A2

From Bechtel V.P. #8856-J8-5-3

ATTACHMENT -2
Sht 7 of 9

MAXIMUM DISPLACEMENT: .060 inches

MAXIMUM ACCELERATION: 1.450 g (horz.)
0.482 g (vert.)

| MAXIMUM STRESSES | | | | |
|---|---|---|---|---|
| PANEL COMPONENT | STRESS TYPE | MAXIMUM VALUE | ALLOWABLE VALUE | MAXIMUM ALLOWABLE |
| (a) Mounting Plates | Shear | 104 | 14400 | 0.007 |
| | Flexure | 2011 | 27000 | 0.075 |
| (b) Cabinet | | | | |
| Top | Shear | 90 | 13200 | .007 |
| Sides | Shear | 186 | 13200 | .014 |
| Door Jamb | Shear | 126 | 13200 | .010 |
| | Flexure | 7707 | 19800 | .389 |
| Stiffeners | Shear | 154 | 13200 | .012 |
| | Flexure | 42 | 19800 | .002 |
| Separator Wall | Shear | 140 | 13200 | .011 |
| (c) Welds | Shear | 1131 (side plates) | 18000 | .063 |
| (d) Anchorage weld | Combined Shear & Tension | 796 psi. | 18000 | 0.044 |

TABLE 4.1 SUMMARY OF MAXIMUM STRESSES IN PANEL 2C694

From Bechtel W.P #8856-J8-6-3

MAXIMUM DISPLACEMENT: .0116 inches

MAXIMUM ACCELERATION: 1.330g (horiz)
0.641 (vert)

MAXIMUM STRESSES: *

| PANEL COMPONENT | STRESS TYPE | MAXIMUM VALUE | ALLOWABLE VALUE | MAXIMUM ALLOWANCE |
|---|---|---|---|---|
| (a) Mounting Plates | Shear | 240 | 14400 | .017 |
| | Flexure | 730 | 27000 | .027 |
| (b) Cabinet | | | | |
| Sides | Shear | 35 | 13200 | .003 |
| Top | Shear | 23 | 13200 | .002 |
| Door Mullions | Shear | 166 | 13200 | .013 |
| | Flexure | 4478 | 19800 | .226 |
| Tee Stiffeners | Shear | 95 | 14400 | .007 |
| | Flexure | 2624 | 21600 | .122 |
| Channel Stiffeners | Shear | 49 | 14400 | .003 |
| | Flexure | 922 | 21600 | .043 |
| Plate Stiffeners | Shear | 84 | 14400 | .006 |
| | Flexure | 1880 | 21600 | .087 |
| (c) Welds | Shear | 2036 (mountings) | 18000 | .113 |
| (d) Anchor Bolts | Combined shear & tension | 250 | 1200 | 0.21 |

TABLE 5.1 Summary of Maximum Stresses in Panel 2C201B

* The stresses include the effects of LOCA loads. In fact this panel is not required to sustain LOCA loads.

From Bechtel VP # 8856-J8-7-3

MAXIMUM DISPLACEMENT: .0044 inches

MAXIMUM ACCELERATION: .756g (vert)
.694g (horz)

MAXIMUM STRESSES:

| PANEL COMPONENT | STRESS TYPE | MAXIMUM VALUE lbs. | ALLOWABLE VALUE lbs. | MAXIMUM / ALLOWABLE |
|---|---|---|---|---|
| (a) Mounting Plates | Shear | 513 | 13200 | .039 |
| | Flexure | 266 | 22000 | .012 |
| (b) Cabinet Sides | Shear | 77 | 13200 | .006 |
| Top Angles | Shear | 220 | 14400 | .015 |
| | Flexure | 5125 | 21600 | .237 |
| Side Beams | Shear | 124 | 13200 | .009 |
| | Flexure | 10006 | 19800 | .505 |
| Inner Stiffeners | Shear | 117 | 13200 | .009 |
| | Flexure | 481 | 19800 | .024 |
| Added Angle Stiffeners | Shear | 50 | 14400 | .003 |
| | Flexure | 676 | 21600 | .031 |
| (c) Welds | Shear | 2760 (mounting plate) | 18000 | .153 |
| (d) Anchor Bolts | Combined Shear & Tension | 636 lbs. | 1200 | 0.53 |

TABLE 5.1 SUMMARY OF STRESS ANALYSIS IN PANEL 2C222

## RESPONSE TO NRC QUESTION ITEM #IV (4)

Question:

For Containment Vacuum Relief Valve (M-149) provide clarification for the consideration of the loads at the free end of the downcomer during qualification (12/31/81).

Response:

There are five pairs of vacuum relief valves in each unit. The valves are in series and bolted to T-flanges of the downcomer at one end and supported by a pair of diagonal bracing angles (4" x 4" x 3/8") on the outboard end. The model for the analysis of the valves includes the details of the valve components, the downcomer, the downcomer bracing system and the bracing angles as shown in the attached Figure 1.

In addition to the dead load and the pressure load (vacuum operating set pressure of 0.5 psi; positive design pressure of 53 psi), the following dynamic loads have been considered in qualifying the valve:

(1) Inertia Loads:

From seismic, SRV and LOCA applied at the diaphragm slab.

(2) Submerged Structure Loads:

(a) SRV: Pressure time history from KWU trace #76 applied laterally.

(b) LOCA: Pressure time history from KWU traces #303 and #306 applied laterally.

(3) Downcomer Tip Load due to LOCA (chugging):

The present configuration is such that the downcomer carrying the vacuum relief valves are capped at bottom ends. Hence, the direct tip load due to chugging is eliminated for these vents. However, the effect of the tip loads from the adjacent downcomers as transmitted through the bracing has been considered for a multiple vent discharge. This load consists of a 30 kip impulse applied as a half sine wave with a duration of 3 milliseconds. A multiple vent discharge factor of 0.25 is taken into account.

The total loads stresses and displacements are determined in the following manner:

(i) the responses for the SRV inertia load and the SRV submerged structure load are added absolutely.

(ii) the responses for LOCA inertia load, LOCA submerged structure load and the chugging tip load are added absolutely.

(iii) the responses from the above (i & ii) SRV and LOCA and the responses from seismic loads are added by SRSS method.

(iv) the total dynamic responses from (iii) are then added to the results of dead load and the pressure loads are added absolutely to obtain the final stresses and displacements.

The analysis of the valve show that there are adequate margins of safety in all the valve components and hence, it is concluded that the valve is satisfactorily qualified for hydrodynamic loads.

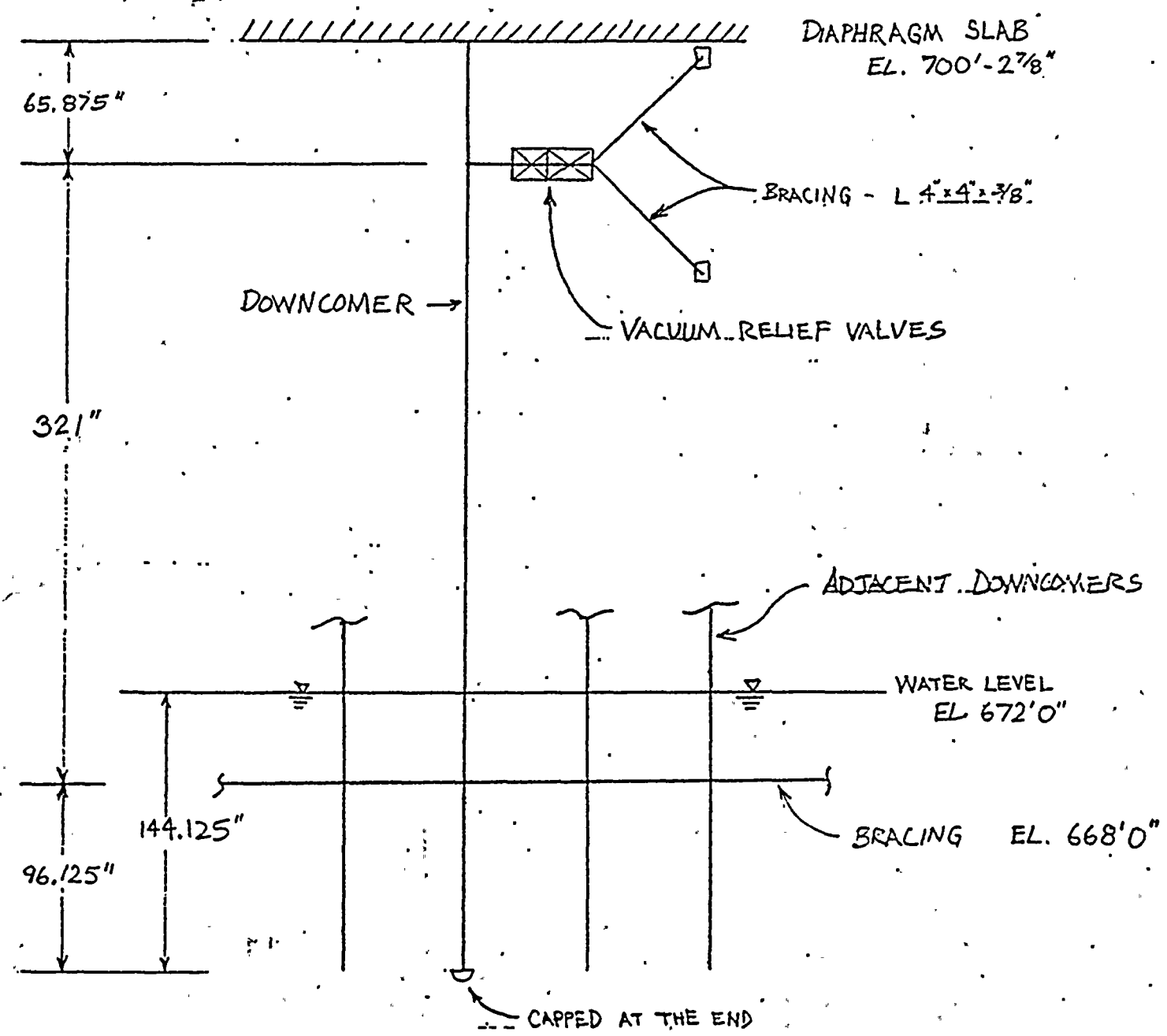



Figure - 1 : SCHEMATIC MODEL OF DOWNCOMER WITH VACUUM RELIEF VALVES