

PRELIMINARY ISSUE

Date 10/18/83

VIRGIL C. SUMMER NUCLEAR STATION

SEISMIC CONFIRMATORY PROGRAM

SAMPLE EXAMPLE 4

EQUIPMENT NAME & SYSTEM: Charging/Safety Injection Pumps

EQUIPMENT TAG NUMBER
& LOCATION : XPP-43A Auxiliary Building El. 388'
XPP-43B "
XPP-43C "

EQUIPMENT VENDOR : Pacific Pumps

QUALIFIED BY : "Analysis"

QUALIFICATION REPORT : Westinghouse Equipment Specification 678815
(Westinghouse Proprietary)
Pacific Pump Contract 546-CAL-169450-BN

MARGIN AGAINST ACRS : 8.55

MARGIN AGAINST ASLB : 1.78

WESTINGHOUSE ELECTRIC CORPORATION

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A C R S

REQUIRED RESPONSE SPECTRA (RRS)

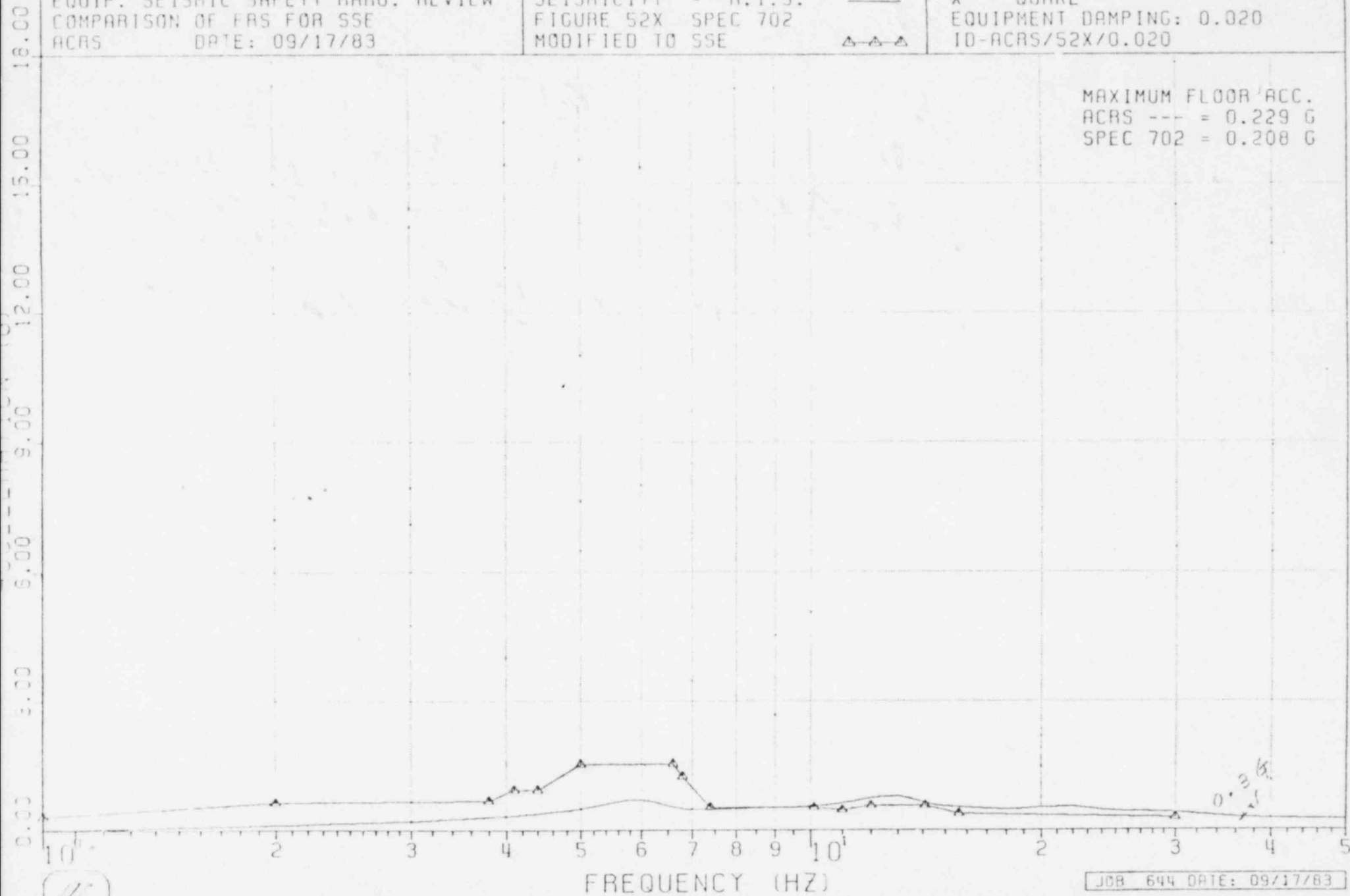
SAMPLE EXAMPLE 4

SCE&G V.C. SUMMER NUCLEAR STATION
EQUIP. SEISMIC SAFETY MARG. REVIEW
COMPARISON OF FAS FOR SSE
ACRS DATE: 09/17/83

ACRS-RESERVOIR INDUCED
SEISMICITY - R.I.S.
FIGURE 52X SPEC 702
MODIFIED TO SSE

AUXILIARY BLOC EL 388-0
X QUAKE
EQUIPMENT DAMPING: 0.020
ID-ACRS/52X/0.020

MAXIMUM FLOOR ACC.
ACRS --- = 0.229 G
SPEC 702 = 0.208 G



SCE&G V.C. SUMMER NUCLEAR STATION
EQUIP. SEISMIC SAFETY MARG. REVIEW
COMPARISON OF FRS FOR SSE
ACRS DATE: 09/17/83

ACRS-RESERVOIR INDUCED
SEISMICITY - R.I.S.
FIGURE 52Y SPEC 702
MODIFIED TO SSE

AUXILIARY + BLDG EL 388-0
Y QUAKE
EQUIPMENT DAMPING: 0.020
10-ACRS/52Y/0.020

MAXIMUM FLOOR ACC.
ACRS --- = 0.215 G
SPEC 702 = 0.200 G

ACCELERATION (G)

FREQUENCY (HZ)



SCE&G V.C. SUMMER NUCLEAR STATION
EQUIP. SEISMIC SAFETY MARG. REVIEW
COMPARISON OF FRS FOR SSE
ACRS DATE: 09/17/83

ACRS-RESERVOIR INDUCED
SEISMICITY - R.I.S.
FIGURE 52V SPEC 702
MODIFIED TO SSE

AUXILIARY BLDG EL 388-0
VERT QUAKE
EQUIPMENT DAMPING: 0.020
10-ACRS/52V/0.020

MAXIMUM FLOOR ACC.
ACRS --- = 0.219 G
SPEC 702 = 0.152 G

ACCELERATION (G)

0.00
1.00
2.00
3.00
4.00
5.00
6.00

FREQUENCY (HZ)

10⁰ 2 3 4 5 6 7 8 9 10¹ 2 3 4 5



A S L B

REQUIRED RESPONSE SPECTRA (RRS)

SAMPLE EXAMPLE 4

SCE&G V.C. SUMMER NUCLEAR STATION EQUIP. SEISMIC SAFETY MARG. REVIEW COMPARISON OF FRS FOR SSE ASLB DATE: 09/17/83	ASLB-MODIFIED ENVELOPE OF MONTICELLO EVENTS FIGURE 52X SPEC 702 MODIFIED TO SSE	AUXILIARY 1 BLDG EL 388-0 X QUAKE EQUIPMENT DAMPING: 0.020 10-ASLB/52X/0.020
---	--	---

MAXIMUM FLOOR ACC.
ASLB --- = 0.221 G
SPEC 702 = 0.208 G

18.00

15.00

12.00

ACCELERATION (G)

9.00

6.00

3.00

0.10

10⁰

FREQUENCY (HZ)

2 3 4 5 6 7 8 9 10¹

1.0
0.5
0.2

SCE&G V.C. SUMMER NUCLEAR STATION
 EQUIP. SEISMIC SAFETY MARG. REVIEW
 COMPARISON OF FRS FOR SSE
 ASLB DATE: 09/17/83

ASLB-MODIFIED ENVELOPE
 OF MONTICELLO EVENTS
 FIGURE 52Y SPEC 702
 MODIFIED TO SSE

AUXILIARY 16LDC EL 388-0
 Y QUAKE
 EQUIPMENT DAMPING: 0.020
 ID-ASLB/52Y/0.020

MAXIMUM FLOOR ACC.
 ASLB --- = 0.212 G
 SPEC 702 = 0.200 G

18.00

15.00

12.00

ACCELERATION (G)

9.00

6.00

3.00

0.00

10⁰

FREQUENCY (HZ)

2 3 4 5 6 7 8 9 10

2 3 4 5



SCE&G V.C. SUMMER NUCLEAR STATION
EQUIP. SEISMIC SAFETY MARG. REVIEW
COMPARISON OF FRS FOR SSE
ASLB DATE: 09/17/83

ASLB-MODIFIED ENVELOPE
OF MONTICELLO EVENTS
FIGURE 52V SPEC 702
MODIFIED TO SSE

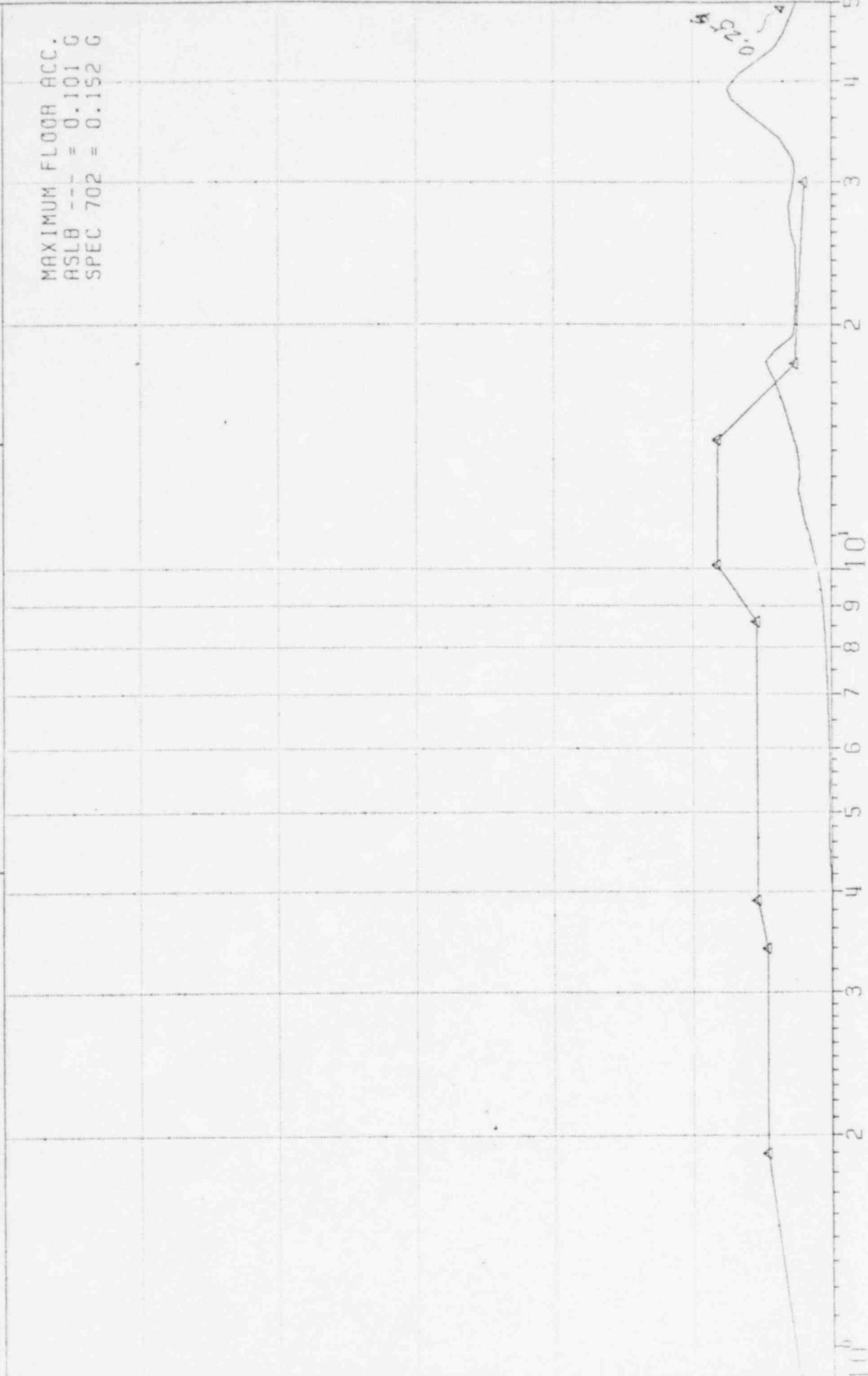
AUXILIARY #BLDG EL 388-0
VERT QUAKE
EQUIPMENT DAMPING: 0.020
10-ASLB/52V/0.020

MAXIMUM FLOOR ACC.
ASLB --- = 0.101 G
SPEC 702 = 0.152 G

ACCELERATION (G)

FREQUENCY (HZ)

JOB 654 DATE: 09/17/83



RELEVANT INFORMATION
FOR
QUALIFICATION ANALYSIS
SUMMARY OF RESULTS

- 8) Supplementary QR's were written for accessories not present at initial release.
- 9) Summary of Qualification is attached.

The following is a brief discussion of how the qualification process proceeds as it relates to the charging/safety injection pumps supplied to V. C. Summer Nuclear Station.

Please note that CGE is the Westinghouse project code for the Summer Station and is used throughout in lieu of the entire station title.

- 1) A generic (or base) equipment spec. was prepared for ASME Sec. III Class 2 pumps (678815). It was supplemented by additional specific information for the charging/SI pumps at CGE and several other projects. This was done in spec. addendum 952274. Section 3.1.21 of 678815 includes requirements for structural integrity and operability.
- 2) A base purchase order was placed with Pacific Pumps (169450). It contains general administrative and technical requirements for charging/SI pumps for CGE and other plants.
- 3) Purchase order 169458 was added for project CGE only. Requirements in 169458 take precedence over those in 169450 for the CGE equipment.
- 4) Change notice 006 to 169450 incorporates spec. 678815 Rev. 2 as a requirement for all projects on base order 169450.
- 5) Change notice 007 to 169458 incorporates spec. addendum 952274 Rev. 2 as applicable to CGE.
- 6) A report was submitted for approval which verified the pumps (by project and pump serial number) for the structural integrity and operability requirements of the specification. It was approved as being acceptable verification.
- 7) The three pumps were released on Westinghouse quality releases 21498 and 21499. The releases tie the pump serial number, project (CGE), purchase order number, and applicable specifications together. It also verifies by the "audit checklist" section that all applicable documentation was reviewed and acceptable.

SUMMARY OF QUALIFICATION

The charging pumps were procured to 3g's horizontal and 2g's vertical per paragraph 3.1.21.4 of specification 678815. This is equivalent to 2.1g's in three mutually perpendicular directions per WCAP 8230 which has been reviewed and accepted by the NRC.

A summary of stresses at the three most critically stressed sections is attached. These stresses are the result of the 2.1, 2.1, 2.1g loading.

Specific requirements for the Virgil Summer Nuclear Station charging pumps in the Auxiliary Building at 388' elevation based on the ASLB spectra* are 1.90, 0.79, 0.25g's in directions x, y, and vertical. Based on the ACRS spectra*, the requirements are 0.30, 0.22, 0.22g's again in x, y and vertical. Therefore, the margin between the actual requirements and the qualified level is considerable.

*Spectra dated 9/17/83

Summary of Most Severely Stressed Sections.

<u>Section</u>	<u>Resultant (1)</u> <u>Stress, psi</u>	<u>(2)</u> <u>Allowable, psi</u>	<u>(3)</u> <u>Margin(ACRS)</u>	<u>Margin(ASLB)</u>
Discharge Flange Stress	32,680	33,200	8.55 *	1.78 *
Suction Nozzle	14,815	16,600	9.43	1.97
Discharge Nozzle Bolts	21,771	25,000	9.66	2.02

- (1) Resultant stress is calculated on basis of a 2.1G input in both X, Y, and Vertical directions.
- (2) Allowable stress is based on ASME Boiler and Pressure Vessel Code Section III, 1971.
- (3) Margin is calculated for each subcomponent as

$$\frac{\sqrt{2.1^2 + 2.1^2 + 2.1^2}}{\sqrt{Sax^2 + Say^2 + Sav^2}} \times \frac{\text{Allowable Stress}}{\text{Resultant Stress}}$$

where:

- Sax = Spectral acceleration in X direction of a 2% damping RRS curve = 0.30G (ACRS); 1.90G (ASLB)
- Say = Spectral acceleration in Y direction of a 2% damping RRS curve = 0.22G (ACRS); 0.79G (ASLB)
- Sav = Spectral acceleration in Vertical direction of a 2% damping RRS curve = 0.22G (ACRS); 0.25G (ASLB)

The fundamental frequency of this equipment is 38.8 hz in X direction. All the other modes have frequency higher than 50 hz. For those higher modes Spectral acceleration at 50 hz is used.

- * The smallest margin among the three subcomponents is defined as the equipment margin and presented on the front cover page.