



Westinghouse
Electric Corporation

Energy Systems

Box 355
Pittsburgh Pennsylvania 15230-0355

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June 1, 1995

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: T. R. QUAY

SUBJECT: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION DURING
A MEETING WITH THE NRC STAFF ON MAY 10, 1995 RELATED TO
REACTOR VESSEL INTERNALS VIBRATIONS

Dear Mr. Quay:

The following information is provided in response to a request for additional information during a meeting with the NRC staff on May 10, 1995 related to reactor vessel internals vibrations.

The calculated stresses or loads due to flow-induced and pump-induced vibrations and the design allowable limits are summarized in Table 1 (attached). This table shows that all calculated values are lower than allowable values.

The calculated stresses and loads are judged to include considerable conservatism. In addition to the use of mechanical design flow rates which are greater than best estimate flow rates, examples of conservatism or worst case assumptions include:

- That organized vortex streets can be shed due to crossflow on the vortex suppression plate structures and that the vortex shedding in the lateral direction will be at a frequency that is equal to the natural frequency of the structure.
- That the natural frequency of a structural mode will be coincident with pump-induced natural frequencies although coincidence is not calculated.
- The structural models include no torsional degrees of freedom of the upper and lower internals assemblies. This, in conjunction with the assumption that the loads are taken by one key/clevis at the worst case offset, results in a conservatism.

The allowable values are ASME Code fatigue design values at 10^{11} cycles which in themselves include a factor of safety of 2 on stress.

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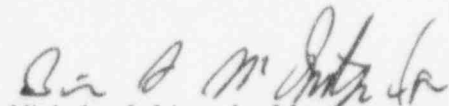
The key and pin allowable loads are interface values which reflect the relatively small portion of the total load capability allowed for flow-induced vibration (as opposed to seismic loads, for example).

These values would be suitable for conservative expected values for plan testing. They will be considered in the evaluations carried out for the internal stress report.

Regarding the guide tubes and support columns, as discussed in the meeting, further work is required to define margins for flow-induced vibration.

If you have any questions, please contact Don A. Lindgren at (412) 374-4856.

Sincerely,



Nicholas J. Liparulo, Manager
Nuclear Safety Regulatory and Licensing Activities

/nja

Attachment

cc: W. Huffman, NRC
S. Hou, NRC
B. A. McIntyre, Westinghouse

TABLE 1 - SUMMARY OF STRESSES/LOADS AND ALLOWABLE VALUES FROM REPORT NUMBER MI01-GER-001, REV. 1 (MAY 1995)

AP600 REACTOR INTERNALS COMPONENT	REPORT PAGE	STRESS/LOAD	ALLOWABLE*	F. S.
CORE BARREL FLANGE (beam mode)	53	2465 psi	13,000 psi ⁽¹⁾	5.3
RADIAL REFLECTOR (shell mode) (beam mode) (combined)	53	300 psi 242 psi < 550 psi	13,000 psi ⁽¹⁾ 13,000 psi ⁽¹⁾ 13,000 psi ⁽¹⁾	32.6 (> 20)
REFLECTOR TIE ROD	54	694 psi	13,000 psi ⁽¹⁾	18.7
REFLECTOR LOCATING PIN	54	922 psi	13,000 psi ⁽¹⁾	14.1
LOWER CORE PLATE TO CORE BARREL WELD (total)	55	1226 psi	13,000 psi ⁽¹⁾	10.6
VORTEX SUPPRESSION PLATE INNER COLUMN	56	12,225 psi	13,000 psi ⁽¹⁾	1.1
VORTEX SUPPRESSION PLATE INNER COLUMN BOLT	56	6912 psi	13,000 psi ⁽¹⁾	1.9
VORTEX SUPPRESSION PLATE OUTER COLUMN	56	9166 psi	13,000 psi ⁽¹⁾	1.4
VORTEX SUPPRESSION PLATE OUTER COLUMN BOLT	56	2827 psi	13,000 psi ⁽¹⁾	4.6
UPPER SUPPORT PLATE (perforated region)	57	912 psi	13,000 psi ⁽¹⁾	14.2
UPPER SUPPORT PLATE TO SKIRT RADIUS	57	393 psi	13,000 psi ⁽¹⁾	33.1
UPPER SUPPORT FLANGE TO SKIRT RADIUS	57	328 psi	13,000 psi ⁽¹⁾	39.6
GUIDE TUBES	57	< 13,000 psi	13,000 psi ⁽¹⁾	See Note 4
SUPPORT COLUMNS	57	< 13,000 psi	13,000 psi ⁽¹⁾	See Note 4
LOWER RADIAL SUPPORT KEYS (vibratory)	61	21,830 lb	25,000 lb ⁽²⁾	1.15
UPPER CORE PLATE ALIGNMENT PINS (vibratory)	61	5598 lb	16,000 lb ⁽³⁾	2.86

*NOTES:

- 1) Based on ASME B&PV Code Section III, Appendix I, Figure I-9.2.2 (Curve C) for 10^{11} cycles.
- 2) AP600 Document no. RXS-M8-001, Revision B.
- 3) AP600 Document no. MI01-M2C-001.
- 4) Westinghouse Pensacola to confirm later by analyses or test.