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The Secretary of the Commission
U.S. Nuclear Regulatory Commission
Attention Docketing and Service Section
Washington, D.C. 20555

June 8, 1978

Gentlemen:

We are pleased to submit our comments on the attached six pages of text on Regulatory Guide 1.124 "Service Limits and Loading Combinations for Class 1 Linear-Type Component Supports, Revision 1, January 1978."

Stone & Webster Engineering Corporation appreciates this opportunity to contribute to the improvement of Regulatory Guide 1.124.

Very truly yours,

S B Jacobs

S. B. Jacobs
Chief Licensing Engineer

Enclosures

DFG:VMB

Card 6/16

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"DESIGN LIMITS AND LOADING COMBINATIONS FOR CLASS 1 LINEAR TYPE COMPONENT SUPPORTS" - REGULATORY GUIDE 1.124

GENERAL COMMENTS

Regulatory Guide 1.124 provides little guidance concerning what specific loads should be combined or the methods of combination to be used. Instead, the RG indicates that Class 1 linear type component supports should be designed to significantly lower allowables than currently permitted by the ASME Code, Section III.

The emphasis on reduced allowables for supports is apparently based on interpretation of Code statements that Code allowables do not guarantee funtional capability and, therefore, design to Code allowables will, in fact, result in loss of function, or at least a high probability that function will be lost. This, however, is not the case. Conformance to Code stress limits for component supports preclude large deformations and/or collapse or buckling failures. If small deformations are important in the function of the component support, deformation limits are provided in the Design Specification.

There are many other conservatisms that are applied to nuclear power plant design, including:

1. Conservative earthquake criterion
2. Consideration of postulated unlikely events
3. Single active failure criterion
4. Redundant safety systems

The adequacy of these conservatisms, coupled with current Code requirements for component supports (or even less stringent requirements on old plants), has been demonstrated in the service history of operating plants. The need to significantly increase the conservatism of support designs has not been demonstrated.

On the other hand, a significant increase in conservatism in support designs may have an adverse effect on overall plant safety. More conservative criteria results in heavier and stiffer supports. Heavy support sections are more prone to problems such as lamellar tearing and brittle fracture. Stiffer supports generally produce higher loads at the component-component support interface and will increase operating stresses in the components.

B. Discussion
Specific Comment

5/12/78
R.G. 1.124, Rev. 1

(1.) Reference: B.1.b, Discussion, Pg. 1.124-2

Existing Text

1. Design by Linear Elastic Analysis

b. *Allowable Increase of Service Limits.* While NF-3231.1(a), XVII-2110(a), and F-1370(a) of Section III all permit the increase of allowable stresses under various loading conditions, XVII-2110(b) limits the increase so that two-thirds of the critical buckling stress for compression and compression flange members is not exceeded, and the increase allowed by NF-3231.1(a) is for stress range. Critical buckling stresses with normal design margins are derived in XVII-2200 of Section III. Since buckling prevents "shakedown" in the load-bearing member, XVII-2110(b) must be regarded as controlling. Also, buckling is the result of the interaction of the configuration of the load-bearing member and its material properties (i.e., elastic modulus E and minimum yield strength S_y). Because both of these material properties change with temperature, the critical buckling stresses should be calculated with the values of E and S_y of the component support material at temperature. Allowable service limits for bolted connections are derived from tensile and shear stress limits and their nonlinear interaction; they also change with the size of the bolt. For this reason, the increases permitted by NF-3231.1, XVII-2110(a), and F-1370(a) of Section III are not directly applicable to allowable shear stresses and allowable stresses for bolts and bolted connections. The increase permitted by NF-3231.1 and F-1370(a) of Section III for shear stresses or shear stress range should not be more than 1.5 times the level A service limits because of the potential for non-ductile behavior.

Proposed Text

The increased allowable permitted for tensile stress in bolts should not exceed 0.70 S_u at temperature. The increased allowable permitted for shear stress in bolts should not exceed 0.42 S_u at temperature.

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Comment:

An upper limit of 0.70 S_u for allowable tensile stress in bolts and 0.42 S_u for allowable shear stress in bolts is consistent with present Code allowables and conservative.

B. Discussion
Specific Comment

5/12/78
R.G. 1.124, Rev. 1

(2.) Reference: B.5, Discussion, Pg. 1.124-3

Existing Test

5. Function of Supported System

In selecting the level of service limits for different loading combinations, the function of the supported system must be taken into account. To ensure that systems whose normal function is to prevent or mitigate consequences of events associated with an emergency or faulted plant condition (e.g., the function of ECCS during faulted plant conditions) will operate properly regardless of plant condition, the Code level A or B service limits of Subsection NF (which are identical) or other justifiable limits provided by the Code should be used.

Since Appendix XVII derives all equations from AISC rules and many AISC compression equations have built-in constants based on mechanical properties of steel at room temperature, to use these equations indiscriminately for all NF and the latest accepted version of Code Case 1644 materials at all temperatures would not be prudent. For materials other than steel and working temperatures substantially different from room temperature, these equations should be rederived with the appropriate material properties.

Proposed Text

In selecting the level of service for different loading combinations, the function of the supported system must be taken into account. To ensure that systems containing active components whose normal safety-related function is to prevent or mitigate consequences of events associated with an emergency or faulted plant condition (e.g., the function of the ECCS system during faulted plant conditions) will operate properly regardless of plant condition, the Code level A or B service limits of Subsection NF (which are identical), or other justifiable limits provided by the Code, should be used.

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C. Regulatory Position
Specific Comment

(1) Reference: C3, Regulatory Position, Pg. 1.124-4

Existing Text	Proposed Text
b. The shear stress limit F_v for a gross section as specified in XVII-2212 of Section III should be the smaller value of $0.4S_y$ or $0.33S_u$ at temperature.	
Many limits and equations for compression strength specified in Sections XVII-2214, XVII-2224, XVII-2225, XVII-2240, and XVII-2260 have built-in constants based on Young's Modulus of 29,000 Ksi. For materials with Young's Modulus at working temperatures substantially different from 29,000 Ksi, these constants should be rederived with the appropriate Young's Modulus unless the conservatism of using these constants as specified can be demonstrated.	C.3.c. The bending stress limit F_b, resulting from tension and bending in structural members as specified in Appendix XVII-2214 of Section III, Division 1, should be the smaller value of 0.66 S_y or 0.55 S_u for compact sections, 0.75 S_y or 0.63 S_u for doubly symmetrical members with bending about the minor axis, and 0.6 S_y or 0.5 S_u for box-type flexural members and miscellaneous members.
4. Component supports designed by linear elastic analysis may increase their level A or B service limits according to the provisions of NF-3231.1(a), XVII-2110(a), and F-1370(a) of Section III. The increase of level A or B service limits provided by NF-3231.1(a) is for stress range. The increase of level A	

Comment:

The paragraph added to Regulatory Position C.3 is necessary because of an apparent oversight in applying the 5/6 factor to bending stress allowables.

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C. Regulatory Position
Specific Comment

(2) Reference: C4, Regulatory Position, Pg. 1.124-5

Existing Text	Proposed Text
4. Component supports designed by linear elastic analysis may increase their level A or B service limits according to the provisions of NF-3231.1(a), XVII-2110(a), and F-1370(a) of Section III. The increase of level A or B service limits provided by NF-3231.1(a) is for stress range. The increase of level A or B service limits provided by F-1370(a) for level D service limits should be the smaller factor of 2 or $1.167S_u/S_y$, if $S_u \geq 1.2S_y$, or 1.4 if $S_u \leq 1.2S_y$, where S_y and S_u are component-support material properties at temperature. However, all increases [i.e., those allowed by NF-3231.1(a), XVII-2110(a), and F-1370(a)] should always be limited by XVII-2110(b) of Section III. The critical buckling strengths defined by XVII-2110(b) of Section III should be calculated using material properties at temperature. This increase of level A or B service limits does not apply to limits for bolted connections. Any increase of limits for shear stresses above 1.5 times the Code level A service limits should be justified.	The increased allowable permitted for tensile stress in bolts shall not exceed 0.70 S_u at temperature. The increased allowable permitted for shear stress in bolts shall not exceed 0.42 S_u at temperature.

Comment:

See discussion under reference B.1.b.

(3) Reference: C5a, Pg. 1.124-5

Existing Text	Proposed Text
a. The stress limits of XVII-2000 of Section III and Regulatory Position 3 of this guide should not be exceeded for component supports designed by the linear elastic analysis method. These stress limits may be increased according to the provisions of NF-3231.1(a) of Section III and Regulatory Position 4 of this guide when effects resulting from constraints of free-end displacements are added to the loading combination.	These stress limits may be increased according to the provisions of NF-3231.1(a) of Section III and Regulatory Position 4 of this guide when effects resulting from constraint of free-end displacement and anchor motions are added to the loading combination.

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Comment:

Loads developed by anchor motions are also deformation limited and as such are considered to be grouped in the same category as loads from restraint of free-end displacement. The resulting stresses are essentially of the secondary type.

(4) Reference: C8, Regulatory Position, Pg. 1.124-6

Existing Text	Proposed Text
8. Component supports in systems whose normal function is to prevent or mitigate the consequences of events associated with an emergency or faulted plant condition should be designed within the limits described in Regulatory Position 5 or other justifiable limits provided by the Code. These limits should be defined by the Design Specification and stated in the PSAR, such that the function of the supported system will be maintained when they are subjected to the loading combinations described in Regulatory Positions 6 and 7.	Component supports for "active" components that are required only during an emergency or faulted plant condition and that are subjected to loading combinations described in Regulatory Positions C.6 and C.7 should be designed within the design limits described in Regulatory Position C.5 or other justifiable design limits. These limits should be defined by the Design Specification and stated in the PSAR, such that the function of the supported system will be maintained when they are subjected to the loading combinations described in Regulatory Positions 6 and 7.

Comment:

Regulatory Position C.8 is revised as shown because this section implies that the lower stress limits associated with the Design Levels A and B Service Limits must be used for any component support that serves a safety-related function during an Emergency or Faulted plant condition. This would seem to imply that a main coolant pump support, which constitutes a passive element in the main coolant loop, would have to be designed to meet the Design, Level A and B Service Limits during an Emergency or Faulted (LOCA) plant condition. This would require that a snubber providing restraint on an RHR line would have to be designed to the Design, Level A and B Service Limits during an Emergency or Faulted plant condition. If this is the intent, it is a severe departure from current practice. Only active components, such as valves, whose operation is required for safe shutdown during an Emergency or Faulted condition have been required to meet design stress limits for these plant conditions. Level C and D Service Limits have been considered adequate to assure pressure boundary integrity under the more severe operating conditions.