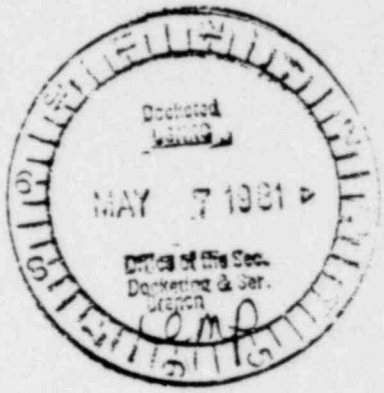
E-SYSTEMS
Montek Division



DO NOT NUMBER
PROPOSED RULE PR-Misc. Notice
(Reg Guide)

13 April 1981

In Reply Please Refer To:
590/81L-014

United States
Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Dan Guzy
Structures And Component Standards Branch

Dear Dan:

Please find enclosed a copy of E-Systems comments on your draft regulatory guide.

I circulated your draft to my functional groups and combined all of their comments into one document.

We at E-Systems thank you and the NRC for soliciting our comments and hope we can be of some assistance to you. If you have any questions regarding our philosophy on snubbers, please feel free to call myself or Frank Bernhard.

Sincerely,

E-SYSTEMS, INC.
MONTEK DIVISION

Elmer Long

Elmer Long
Marketing Manager
Industrial Products

Enclosures

/hdd

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E-SYSTEMS
Montek Division

QUALIFICATION AND ACCEPTANCE TESTS FOR SNUBBERS USED IN SYSTEMS IMPORTANT TO SAFETY

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF STANDARDS DEVELOPMENT
DRAFT REGULATORY GUIDE AND VALUE/IMPACT STATEMENT

TASK SC 708-4
FEBRUARY 1981

E-Systems, Montek Division has reviewed the draft regulatory guide and is in complete agreement with the requirements for qualification and acceptance testing of snubbers used in systems important to safety. E-Systems has qualification tested two production snubbers of each load rating produced. A total of twelve snubbers, six pairs, were tested. Every E-Systems snubber is acceptance tested prior to delivery.

A thorough review of the draft regulatory guide has been made and the following comments are offered regarding same. Sentences and paragraphs of the draft have been repeated so that the comments can be related directly to the draft.

1. Page 2.

   Materials specified or exempted in Subsection NF and other materials used in snubbers may be influenced adversely by the operating environment and their own relative compatibility and thus may not remain capable of performing their intended function for the design life of the snubbers.

   It is recommended that the phrase (design life) be changed to (service life). The design life of many materials used in snubbers is equivalent to the design life of the plant. But some materials used in hydraulic and mechanical snubbers have a service life that is significantly less than the plant or snubber design life. These materials may be the best and most durable materials available for the intended function, but may have to be replaced several times during plant life.

21. Paragraph 4.5, Page 16.

It is recommended that the following be added to this paragraph.

f. Bearings and bearing related items.

g. Activation devices, valves, and orifices

22. Page 16.

An acceptable hydraulic fluid leakage rate shall be specified for hydraulic snubbers.

It is suggested that the following sentence be added to this paragraph: Any acceptable change in performance parameters associated with in-service limits, as opposed to new snubber limits, shall be specified.

23. Page 18.

The snubber design to be qualified shall be described in full by its model number, drawing numbers, and total weight.

It is suggested that the phrase (and total weight) be struck from this sentence because it is irrelevant.

24. Paragraph 3.5, Page 19.

Aging simulation procedures to put the snubber units in a condition equivalent to the end of life condition shall be conducted, including sand and dust simulation and a salt spray test similar to MIL-E-5272C if the specified working environment requires it.

It is suggested that the phrase (end of life) be changed to (end of service life).

In addition, it is recommended that radiation simulation be included in this paragraph for qualification units. E-Systems performed radiation simulation during qualification testing. This testing is readily available at reasonable cost if the test specimen is not too large.

25. Page 20, a.

All five parameters described in Section 3.7 shall be determined at the recorded room temperature (or the specified lowest design service temperature ± 10°F (5.5°C), whichever is lower).

It is suggested that this sentence be revised to read: All five parameters described in section 3.7 shall be determined at the recorded room temperature (or the specified lowest design service temperature), whichever is lower.

26. Page 20, 1.

The drag shall be determined for both directions both for the breakaway condition and for the condition of moving at a specified velocity. The values of the drag and the velocity shall be recorded.

It is suggested that the last sentence be revised to read: The values of the drag and the velocity shall be recorded over full snubber stroke.

27. Page 20, 2.

The activation level (where applicable) shall be tested for both directions by rapid cyclic application of a force equal to 5%, 10%, 25%, 50%, and 100% of the rated load.

This sentence is not appropriate. Activation level is a function of velocity or acceleration and is measured by a gradual increase in either of these parameters as opposed to a rapid increase in force. With a rapid application of force, an accurate activation level cannot be measured. Activation generally occurs between 1% and 5% of rated loads and application of loads higher than these are inappropriate.

28. Page 21.

The testing frequency shall be from 3 Hz to 33 Hz at intervals of approximately 3 Hz.

It is suggested that this sentence be revised to read: The testing frequency shall be from 3 Hz to 33 Hz at intervals of approximately 3 Hz or over a larger frequency range if appropriate. (Tests to 100 Hz have been specified.)

29. Page 21.
One-cycle dynamic loading tests with snubber movement centered about the 1/4, 1/2, and 3/4 stroke locations and a loading amplitude equal to the faulted loading shall be performed to demonstrate adequacy of the response.

Earthquake dynamics do not necessarily limit snubber loads to the faulted level for one cycle. Therefore, it is recommended that snubbers be dynamically cycled at faulted load at some specified frequency for no less than 10 seconds.

30. Page 21.
Any damage to the snubber resulting from this test may be evaluated separately or by performance in tests of b. or c. below.

It is E-Systems opinion that this sentence should be struck. It is not appropriate to design snubbers to incur damage as the result of exposure to faulted load.

31. Page 22, e.
The spring rate is less than the specified range for all frequencies at the specified stroke location.

It is suggested that this sentence be revised to read: The spring rate is less than the specified range for each and all frequencies at the specified stroke location.

32. Page 22.
Revisions to the design must be made before the new design can be qualified in accordance with this Appendix.

It is suggested that the following be added to this sentence: Revisions to the design shall be followed by complete re-qualification. No tampering or adjustment shall be allowed throughout qualification testing.

33. Page 22.
The ultimate load capacity of a snubber design shall be determined by analysis.

It is suggested that this sentence be revised to read: The ultimate load capacity of a snubber design shall be determined by analysis or test.

34. Page 22.
The mode of failure, whether the snubber movement will be frozen or free after an ultimate failure, shall be determined by the analysis.

It is suggested that this sentence be revised to read: The mode of failure, whether the snubber movement will be frozen or free after an ultimate failure, shall be determined by the analysis or test.

35. Paragraph 4.4, Page 23.
It is recommended that a pre-test analysis be conducted with complete dimensional inspection of critical elements so that the post-test analysis and dimensional inspection will provide meaningful wear and deterioration information.

36. Page 26.
The snubber shall be described in full by its model number, serial number, drawing numbers, and total weight.

It is suggested that the phrase (and total weight) be struck from this sentence because it is irrelevant.

37. Page 2[illegible].
As a minimum, the following four functional parameters shall be measured for the snubber test under a recorded temperature ambient. They shall include the drag, the dead band, the activation level (when applicable), and the release rate.

It is recommended that acceptance testing include application of rated and faulted loads in both directions.

38. Paragraph 3.6, Page 27.

It is recommended that the test sequence include application of rated load and faulted load in both directions.

39. Page 27, 1.
The drag shall be determined both for the breakaway condition and the condition of moving under a specified velocity. Tests shall be made for both directions.

It is suggested that the last sentence be revised to read: Tests shall be made for both directions over full snubber stroke.

40. Page 27, 2.
The activation level shall be tested for 5%, 10%, 25%, 50%, and 100% of the rated load for both directions.

As mentioned before, the requirement is incorrect. Therefore, it is suggested that this sentence be revised to read: The activation level shall be tested for both directions.

41. Page 27, 4.
The release rate shall be tested at 5%, 10%, 25%, 50% and 100% of the rated load. Tests shall be made for both directions.

Correlation of test data on a number of units may prove that testing at different percents of rated load is not necessary on some snubber designs.

42. Page 28.
The reworked snubber unit may be retested and accepted if it meets the test requirement.

It is suggested that this sentence be revised to read: The reworked snubber shall be completely retested and accepted if it meets the test requirements.

43. Page 32.
Designs may be frozen prematurely as they are qualified and innovation in design would be discouraged.

E-Systems disagrees with this statement. If the snubber manufacturer recognizes in advance that qualification test costs and the potential of re-qualification costs may be incurred, the snubber designs will be more thoroughly evaluated and analyzed and innovations will be incorporated to enhance successful qualification. The press of competition will always determine when it is appropriate to offer new improvements and further innovations in snubber design.

2. Page 3.
The activation level describes the magnitude of the motion that activates the snubber.

It is suggested that this sentence be revised to read: The activation level describes the magnitude of the motion that triggers a change in the dynamic function of the snubber.

3. Page 3.
Some snubber designs may not have an activation characteristic.

It is suggested that this sentence be revised to read: Some snubber designs may not have an activation characteristic but essentially convert from a passive mode to a restraint mode as a function of the velocity or acceleration level imposed.

4. Page 4.
The load-displacement relationship is used by designers for the modeling of snubbers in a system analysis and, in turn, adds to the validity of the system analysis.

It is agreed that this is a draft specifically for snubbers, but the load-displacement relationship that should be used by designers for modeling of snubbers is the spring rate of the complete snubber installation. We have found through analysis that the installed stiffness of the pipe clamp can have a significant impact on the overall spring rate of the installed snubber system.

5. Page 5.
The design could be considered qualified only when more than one test unit has passed the requirements.

It is suggested that this sentence be revised to read: The design could be considered qualified only when more than one test unit of each load rating has passed the requirements. This precludes the qualification of units by

similarity. E-Systems has found that snubbers of different load ratings, that employ similarities in design, do not necessarily all pass the qualification test.

6. Page 5.
Some snubber designs may not have an active triggering characteristics but may rely on passive inherent nonlinear response. In such cases, this test and the determination of the dead band would not be applicable.

The last sentence is not true. It is suggested that both of these sentences be struck from the draft. Dead band is a function of many variables other than the actuation device; therefore, it is appropriate to measure dead band of those snubber designs that do not have an active triggering characteristic.

7. Page 5.
Since its magnitude depends on the loading magnitude and is an indication of the recovery rate of the snubber as it returns to the unactivated condition, it needs to be determined for several levels up to the rated load and also for the faulted load in both directions at a specified temperature.

It is suggested that the last words of this sentence (at a specified temperature), be changed to read (over an operational temperature range).

E-Systems snubbers have very stable release rate as a function of temperature, but it is recognized that some snubbers have a wide variation in release rate as a function of the operational temperature range.

8. Page 6.
Since a snubber works in two directions, testing would need to be performed in both directions at a specified velocity.

It is suggested that this sentence be revised to read: Since a snubber works in two directions, testing would need to be performed in both directions at specified velocities and operational temperatures.

9. Page 6.
The dead band can have a significant effect on performance at all load levels; it is therefore prudent to measure it with the associated loadings at several levels up to the rated load

This statement may be true of mechanical snubbers or for parallel mechanical or hydraulic snubbers, but is not considered appropriate for singular hydraulic snubbers.

10. Page 6.
Because overloading of snubbers could take place under some accident conditions, it is necessary that the snubber fail in a manner that would not result in undesirable strain on the piping system.

It is our opinion that overloading of snubbers to the point of failure will almost invariably result in undesirable strain on the piping system and is beyond the control of the snubber manufacturer. If there is a preferred failure mode for overloaded snubbers, it needs to be defined so that snubber manufacturers can consider this during snubber development.

11. Page 7.
Piping systems are often affected by the fluid flow within the pipes and a low amplitude vibration may be generated.

It is suggested that this sentence be revised to read: Piping systems are often affected by the fluid flow within the pipes and a low to intermediate amplitude vibration may be generated.

Our experience indicates that fluid flow dynamics may generate piping vibrational amplitudes other than low.

12. Page 7.
Some aging may occur during the normal operating period and it is desirable to evaluate the degrading effect of the individual environmental factors in order to determine whether these tests would be performed in part or fully before the main qualification tests are performed.

E-Systems recommends that aging associated with normal operation be performed before the main qualification tests are performed so that any aging impact on normal dynamic performance will be determined.

It is also recommended that aging associated with abnormal operating environment be performed after the main qualification tests are performed but prior to any qualification test associated with abnormal dynamic performance.

13. Page 7, 1.
The materials and production processes selected are compatible with each other and with the intended operating environment for the design life period.

It is suggested that the phrase (design life) be changed to (service life).

14. Page 8, 3.
The completed snubber unit meets the specified requirements for drag, dead band, activation level, release rate, and such other special requirements as may be specified in the functional specification.

It is important that the acceptance test requirements and limits be established so that a snubber will meet the performance requirements and limits over the full environmental/temperature range anticipated in service. It is also recommended that rated load and faulted load be applied in both directions as part of acceptance testing.

15. Page 8.
Activation Level - The axial velocity or acceleration that causes the activation of the snubber.

It is suggested that this sentence be revised to read: Activation Level - The axial velocity or acceleration that causes transition of the snubber from a passive to a restraint mode.

16. Page 9.
The qualification procedure for those with a rated capacity that exceeds the capability of test equipment should be determined on a case-by-case basis.

It is E-Systems opinion that larger snubbers are used in applications that are more critical to plant safety than smaller snubbers and therefore, should not be exempt from full qualification testing.

Several facilities have test equipment that is adequate for testing the very largest snubbers known.

17. Page 9.
The acceptance test loading for snubbers with a rated capacity greater than the capability of test equipment should be determined on a case-by-case basis.

It is E-Systems opinion that larger snubbers are used in applications that are more critical to plant safety than smaller snubbers and therefore, should not be exempt from full acceptance testing.

18. Activation level - The axial velocity or acceleration that causes the activation of the snubber.

It is suggested that this sentence be revised to read: Activation level - The axial velocity or acceleration that causes transition of the snubber from a passive to a restraint mode.

19. Page 14, f.
Limits on acceptable angular offset from the line of action of the load.

The intent of this design requirement is not understood. It is difficult to understand how the line of action can be significantly offset from the center line of the snubber when there is a spherical bearing on both ends.

20. Page 15, b.
Acceptable limits for the dead band at the maximum and minimum working temperatures for the range of working loads and piston locations.

It is suggested that this sentence be revised to read: Acceptable limits for the dead band at the maximum and minimum working temperatures for the range of working loads, piston locations, and dynamic frequencies.