



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

December 17, 1996

MEMORANDUM TO: Chairman Jackson  
Commissioner Rogers  
Commissioner Dicus  
Commissioner Diaz  
Commissioner McGaffigan

FROM: James M. Taylor *[Signature]*  
Executive Director for Operations

SUBJECT: STAFF ACTIONS ACTIVITIES RELATED TO SCREW THREAD GAGING ISSUES

In my memorandum to you dated June 21, 1996, I informed the Commission of staff actions regarding threaded fastener gaging issues raised in the past two years. I specifically noted that the staff planned to participate in ASME Code activities related to the fastener gaging issue and that I would keep the Commission informed of the National Institute of Standards and Technology (NIST) initiative. This memorandum provides an update of the staff activities in these areas.

A member of my staff attended the American Society of Mechanical Engineers (ASME) B1 Committee meetings on Unified Screw Threads in Charlotte, North Carolina, on October 23 and 24, 1996. The trip report for this meeting is attached.

The key points observed during the meetings were: (1) NIST-ASME Research Report on screw thread gaging was discussed in detail; (2) revisions to the ASME B1.1 standard on unified screw threads were reviewed; and (3) a report from the Industrial Fastener Institute (IFI) titled, "Influence of Thread Geometry on Fastener Performance," was given to my staff member for information only.

The NIST-ASME report noted that the ASME B1 standards need to be clarified so that the intent of each standard is more understandable. The ASME B1 committee members emphasized that clarity of the standards falls within the charter of all of the ASME B1 committees and subcommittees. Each committee and subcommittee will examine the standards that it is responsible for and will clarify the intent of those sections as deemed necessary.

The ASME B1.1 standard on unified screw threads is undergoing a major revision. All of the dimensions and tolerances for screw threads are being recalculated since many of the dimensions and tolerances have not been checked for over 100 years. Some minor errors were found in the tables. These errors would not have affected performance or safety.

Contact: James A. Davis  
(301) 415-2713

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The IFI study was initiated to verify claims that pitch diameter controls the ability of fasteners to perform their function. The study showed that large variations in pitch diameter did not affect the functional capability of the fasteners. Another area examined was whether System 22 thread gaging equipment would detect out-of-tolerance fasteners better than System 21 thread gaging equipment. The study showed that System 21 detected out-of-tolerance parts equally as well as System 22.

My staff will continue to attend the ASME B1 committee meetings until we are satisfied that the standards are properly revised and are clarified.

Attachment: As stated

cc: SECY OGC OCA OPA

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UNITED STATES  
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November 21, 1996

MEMORANDUM TO: Keith R. Wichman, Acting Chief  
Materials and Chemical Engineering Branch  
Division of Engineering

THRU: David Terao, Chief *D Terao*  
Chemical Engineering and Metallurgy Section  
Materials and Chemical Engineering Branch

FROM: James A. Davis, Materials Engineer *JAD*  
Chemical Engineering and Metallurgy Section  
Materials and Chemical Engineering Branch

SUBJECT: TRIP REPORT ON THE AMERICAN SOCIETY OF MECHANICAL  
ENGINEERS B1 MAIN COMMITTEE AND SUBCOMMITTEE  
MEETINGS ON OCTOBER 22-24, 1996 IN CHARLOTTE, NC

I attended the American Society of Mechanical Engineers (ASME) B1 Subcommittee Meetings in Charlotte, North Carolina on October 23, 1996. The Subcommittee meetings attended were Subcommittee 10 on Miniature Screw Threads UNM, Subcommittee 15 on Metric J Screw Threads, The B1 Technical Advisory Subcommittee, and B1 Subcommittee 1. I attended the ASME B1 Main Committee meeting on October 24, 1996. Of primary interest to me was the B1 Technical Advisory Subcommittee meeting where the National Institute of Standards and Technology (NIST) funded study conducted by the ASME Center for Research and Technology Development on screw-thread gaging was discussed at some length. The B1 Subcommittee 1 meeting included discussions on the revision of ASME Standard B1.1 on Screw Threads. Additional discussions in all of three areas were repeated at the ASME B1 Main Committee meeting.

Many members of the B1 Technical Advisory Subcommittee voiced concerns about the NIST-ASME report. One concern was that some of the information supplied to the authors of the report was not put in the report. Another complaint was that some of the history of ASME Standard B1 was provided to the authors but was not correctly put in the final document. The members also discussed questions that were submitted to the authors that were not raised or addressed in the final report. One question was, "If System 21 does not insure dimensional conformance, does System 22 or System 23 insure dimensional conformance?" The final concern was that the report has some weaknesses, but it does have some positive conclusions. Committee members felt that another study would be beneficial to resolve some of the issues raised in this report. An example would be, "What influence do thread dimensions have on the performance of the fastener?" NIST has stated that they do not intend to fund

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a follow-on study. The committee members commented that the study concluded that the standards and definitions need clarification, and the resolution of this issue is in the charter of the ASME B1 committees. The current standards and definitions are often presented in such a manner that only experts in the field can understand them. The committee stated that the standards and definitions would be examined and clarified so that the intent is more understandable.

One of the goals of the ASME B1 Subcommittee is to provide oversight of the ongoing revision of ASME Standard B1.1 on UNS screw threads. A detailed revision was started two years ago and the first draft is scheduled to be released for ballot by the end of this year. It is anticipated that the issuance of a revised standard will require several years to complete since the standard will be balloted by the ASME B1 Subcommittee, Main Committee, the Standards Council. The main objectives for the revision are: 1) Eliminate any errors in the standard; 2) Clarify the language in the standard; and 3) Shorten the standard to a reasonable length by eliminating any sections that do not contribute to the standard. The most significant error to be corrected is related to the tables of dimensions with their tolerances. The tables were first developed over 100 years ago and, when the values were recalculated, about 10% were found to be in error although the errors were small. The errors in the tables would not have resulted in any substandard performance and would not have created any safety issues in nuclear applications. The tables previously listed the pitch diameter and the pitch diameter tolerances for nuts and bolts. The revision substitutes functional diameter and pitch diameter for the pitch diameter as shown in Attachment 1. For perfect threads, the functional diameter as measured using System 21 is identical to the pitch diameter as measured using System 22. When the threads are not perfect, the pitch diameter and functional diameter will be different. The ASME B1 Subcommittee will examine the ASME B1 documents in an attempt to clarify any sections that are confusing. They will look closely at ASME B1.7, the standard containing definitions.

One of the members of the Industrial Fastener Institute gave me a copy of their report, "Influence of Thread Geometry on Fastener Performance," published in 1996. This study investigated the effect of nut pitch diameter size on the strength and performance of typical tension-type aerospace joints. A single lot of aerospace bolts were mated with nuts with varying thread dimensions from the standard average size to 0.012 inches oversize. This oversize value exceeds the maximum deviation that we observed during our inspection at San Onofre and is four times the pitch diameter tolerance band. The deviations in nut size did not significantly affect the average tensile strength, the fatigue life, or the torque-tension relationship. A second study was conducted to determine the effect of pitch diameter size on the strength and performance of commercial cap screw and nut assemblies. Five pitch diameter combinations were prepared for the bolts and four pitch diameter combinations were prepared for the nuts. The bolts met minimum tensile strength requirements even when out-of-tolerance by 109%. Bolts and nuts of various sizes were tested to determine the torque-tension relationship. In all cases, the nut-bolt combination exceeded the recommended preload and will provide the necessary clamping force. The final study conducted was to determine if one gaging system would detect out-of-tolerance fasteners better than another system. System 21 detected out-of-tolerance parts equally as well as System 22.



The next meeting of the ASME B1 Committee will be April 15-17, 1997 in Orlando, Florida.

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