



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

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
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

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performance of the fastener?" NIST has stated that they do not intend to fund 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 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.

Attachment

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TABLE 3B LIMITS OF SIZE FOR SELECTED COMBINATIONS OF UNS/UNRS SERIES THREADS

Nominal Size and Threads/in			Series Designation	External (1)								Internal (1)							
				Class	Allow- ance	Major Diameter		Pitch Diameter and Functional Diameter			UNR Minor Diam. Max. (3) (Ref.)	Class	Minor Diameter		Pitch Diameter and Functional Diameter			Major Diameter	
						Max. (2)	Min.	Max. (2)	Min.	Toler- ance			Min.	Max.	Min.	Max.	Toler- ance		
																			Min.
(4) 3	- 10 OR 3 000 - 10	UNS	2A	0 0020	2 9980	2 9851	2 9330	2 9262	0 0068	2 8789	2B	2 892	2 913	2 9350	2 9439	0 0089	3 0000		
(4) 3	- 14 OR 3 000 - 14	UNS	2A	0 0018	2 9982	2 9879	2 9518	2 9459	0 0059	2 9131	2B	2 923	2 938	2 9536	2 9613	0 0077	3 0000		
(4) 3	- 18 OR 3 000 - 18	UNS	2A	0 0016	2 9984	2 9897	2 9623	2 9569	0 0054	2 9322	2B	2 940	2 953	2 9639	2 9709	0 0070	3 0000		
(4) 3 1/4	- 10 OR 3 250 - 10	UNS	2A	0 0021	3 2479	3 2350	3 1829	3 1760	0 0069	3 1268	2B	3 142	3 163	3 1850	3 1939	0 0089	3 2500		
(4) 3 1/4	- 14 OR 3 250 - 14	UNS	2A	0 0018	3 2482	3 2379	3 2018	3 1958	0 0060	3 1631	2B	3 173	3 188	3 2036	3 2114	0 0078	3 2500		
(4) 3 1/4	- 18 OR 3 250 - 18	UNS	2A	0 0016	3 2484	3 2397	3 2123	3 2088	0 0055	3 1822	2B	3 190	3 203	3 2139	3 2210	0 0071	3 2500		
(4) 3 1/2	- 10 OR 3 500 - 10	UNS	2A	0 0021	3 4979	3 4850	3 4329	3 4260	0 0069	3 3788	2B	3 392	3 413	3 4350	3 4440	0 0090	3 5000		
(4) 3 1/2	- 14 OR 3 500 - 14	UNS	2A	0 0018	3 4982	3 4879	3 4518	3 4457	0 0061	3 4131	2B	3 423	3 438	3 4536	3 4615	0 0079	3 5000		
(4) 3 1/2	- 18 OR 3 500 - 18	UNS	2A	0 0017	3 4983	3 4896	3 4622	3 4567	0 0055	3 4321	2B	3 440	3 453	3 4639	3 4711	0 0072	3 5000		
(4) 3 3/4	- 10 OR 3 750 - 10	UNS	2A	0 0021	3 7479	3 7350	3 6829	3 6759	0 0070	3 6288	2B	3 642	3 663	3 6850	3 6941	0 0091	3 7500		
(4) 3 3/4	- 14 OR 3 750 - 14	UNS	2A	0 0018	3 7482	3 7379	3 7018	3 6957	0 0061	3 6631	2B	3 673	3 688	3 7036	3 7115	0 0079	3 7500		
(4) 3 3/4	- 18 OR 3 750 - 18	UNS	2A	0 0017	3 7483	3 7396	3 7122	3 7066	0 0056	3 6821	2B	3 690	3 703	3 7139	3 7211	0 0072	3 7500		
(4) 4	- 10 OR 4 000 - 10	UNS	2A	0 0021	3 9979	3 9850	3 9329	3 9259	0 0070	3 8788	2B	3 892	3 913	3 9350	3 9441	0 0091	4 0000		
(4) 4	- 14 OR 4 000 - 14	UNS	2A	0 0018	3 9982	3 9879	3 9518	3 9456	0 0062	3 9131	2B	3 923	3 938	3 9536	3 9616	0 0080	4 0000		
(4) 4 1/4	- 10 OR 4 250 - 10	UNS	2A	0 0021	4 2479	4 2350	4 1829	4 1758	0 0071	4 1288	2B	4 142	4 163	4 1850	4 1942	0 0092	4 2500		
(4) 4 1/4	- 14 OR 4 250 - 14	UNS	2A	0 0019	4 2481	4 2378	4 2017	4 1955	0 0062	4 1630	2B	4 173	4 188	4 2036	4 2117	0 0081	4 2500		
(4) 4 1/2	- 10 OR 4 500 - 10	UNS	2A	0 0021	4 4979	4 4850	4 4329	4 4258	0 0071	4 3788	2B	4 392	4 413	4 4350	4 4443	0 0093	4 5000		
(4) 4 1/2	- 14 OR 4 500 - 14	UNS	2A	0 0019	4 4981	4 4878	4 4517	4 4454	0 0063	4 4130	2B	4 423	4 438	4 4536	4 4617	0 0081	4 5000		
(4) 4 3/4	- 10 OR 4 750 - 10	UNS	2A	0 0022	4 7478	4 7349	4 6828	4 6756	0 0072	4 6287	2B	4 642	4 663	4 6850	4 6943	0 0093	4 7500		
(4) 4 3/4	- 14 OR 4 750 - 14	UNS	2A	0 0019	4 7481	4 7378	4 7017	4 6954	0 0063	4 6630	2B	4 673	4 688	4 7036	4 7118	0 0082	4 7500		
(4) 5	- 10 OR 5 000 - 10	UNS	2A	0 0022	4 9978	4 9849	4 9328	4 9256	0 0072	4 8787	2B	4 892	4 913	4 9350	4 9444	0 0094	5 0000		
(4) 5	- 14 OR 5 000 - 14	UNS	2A	0 0019	4 9981	4 9878	4 9517	4 9453	0 0064	4 9130	2B	4 923	4 938	4 9536	4 9619	0 0083	5 0000		
(4) 5 1/4	- 10 OR 5 250 - 10	UNS	2A	0 0022	5 2478	5 2349	5 1828	5 1755	0 0073	5 1287	2B	5 142	5 163	5 1850	5 1944	0 0094	5 2500		
(4) 5 1/4	- 14 OR 5 250 - 14	UNS	2A	0 0019	5 2481	5 2378	5 2017	5 1953	0 0064	5 1630	2B	5 173	5 188	5 2036	5 2119	0 0083	5 2500		
(4) 5 1/2	- 10 OR 5 500 - 10	UNS	2A	0 0022	5 4978	5 4849	5 4328	5 4255	0 0073	5 3787	2B	5 392	5 413	5 4350	5 4445	0 0095	5 5000		
(4) 5 1/2	- 14 OR 5 500 - 14	UNS	2A	0 0019	5 4981	5 4878	5 4517	5 4453	0 0064	5 4130	2B	5 423	5 438	5 4536	5 4620	0 0084	5 5000		
(4) 5 3/4	- 10 OR 5 750 - 10	UNS	2A	0 0022	5 7478	5 7349	5 6828	5 6755	0 0073	5 6287	2B	5 642	5 663	5 6850	5 6945	0 0095	5 7500		
(4) 5 3/4	- 14 OR 5 750 - 14	UNS	2A	0 0019	5 7481	5 7378	5 7017	5 6952	0 0065	5 6630	2B	5 673	5 688	5 7036	5 7120	0 0084	5 7500		
(4) 6	- 10 OR 6 000 - 10	UNS	2A	0 0022	5 9978	5 9849	5 9328	5 9254	0 0074	5 8787	2B	5 892	5 913	5 9350	5 9446	0 0096	6 0000		
(4) 6	- 14 OR 6 000 - 14	UNS	2A	0 0020	5 9980	5 9877	5 9516	5 9451	0 0065	5 9129	2B	5 923	5 938	5 9536	5 9621	0 0085	6 0000		

GENERAL NOTES

(a) series designation shown indicates the UN thread form, however, the UNR thread form may be specified by substituting UNR in place of UN in all designations for external use only.

Notes

- (1) Thread classes may be combined. See para. 4.2.
- (2) For Class 2A threads having an additive finish, the maximum major and pitch diameters, after coating, may equal the basic sizes, whose values are the same as maximum values shown for Class 3A in these columns. See paras. 4.1.1 and 4.1.3.
- (3) UN series external thread maximum minor diameter is basic (D_1 in section 11) for Class 3A and basic minus allowance for Classes 1A and 2A.
- (4) One or more of the numbers listed in this row have been changed to correct for calculation and rounding errors. The original numbers from past issues of B1.1 are listed in appendix ----- and are for reference only.

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