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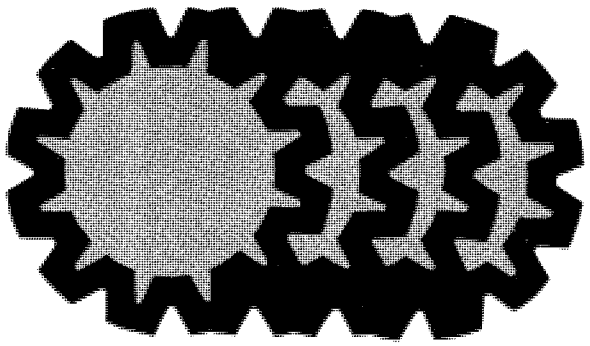
A REPORT ON THE PERFORMANCE OF MEN'S SAFETY-TOE FOOTWEAR



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Results of tests on 76 footwear styles are reported. The test procedures used are in conformity with the requirements of ANSIZ41.4 and agreed upon by user, government, and manufacturing representatives. On the basis of statistical analysis of test data, only about 57% of the styles available at the time of purchase are able to satisfy the requirements of the ANSI Class to which they claim conformity. Most of the observed failures appear to be the result of an overly optimistic performance rating of the shoes. The need is indicated for much tighter control of the ANSI classification to insure that footwear labeled as meeting a given ANSI class does indeed satisfy the requirements of that class. Tighter control over the actual toe box used in a given style may be desirable to eliminate an additional variable in the performance of that style.

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The author wishes to thank Gary Fletcher and Jim Love for their dedication in performing the tests and Ruth Linn for typing the report.

ABSTRACT

Results of tests on 76 footwear styles are reported. The test procedures used were in conformance with the requirements of ANSI Z41.1 and agreed upon by user, government, and manufacturing representatives. On the basis of a statistical analysis of test data, only about 57% of the styles available at the time of purchase would be able to satisfy the requirements of the ANSI Class to which they claimed conformance. Most of the observed failures appear to be the result of an overly optimistic performance rating of the shoes.

INTRODUCTION

In addition to its certification program, the Testing and Certification Branch (TCB) of the National Institute for Occupational Safety and Health (NIOSH) Appalachian Laboratory for Occupational Safety and Health (ALOSH) in Morgantown, West Virginia, is working to develop a body of technical information concerning the personal protective devices offered for use by United States industry. In addition to the data on men's safety-toe footwear presented in this report, TCB is also collecting data on eye and face protective devices, industrial safety helmets, women's safety-toe footwear, and linemen's rubber gloves.

Sections 1910.132 and 1910.136 of the Occupational Safety and Health Standards (29 CFR 1910)[1] require the use of foot protective devices complying with the requirements of American National Standards Institute (ANSI) Standard Z41.1[2] by persons exposed to conditions capable of causing foot injuries. TCB tested a random sample of the safety-toe footwear available during January and February of 1976 and determined the extent of conformance to the requirements of ANSI Z41.1. TCB found significant (43 percent) non-conformance to the standard. In most cases, lack of conformance was the result of exaggerated claims being made for the level of protection provided. For example, a shoe advertised as a Class 75 may, in fact, only provide the protection of a Class 50.

SELECTION AND TESTING

Selection

Twenty-five manufacturers were identified from the lists in Best's Safety Directory[3] and a list of 703 styles of safety-toe footwear was compiled from their catalogs. From this list, 79 styles were randomly selected and an additional 5 styles were chosen from those manufacturers' products not represented in the random sample. Six pairs of the styles selected were ordered. Seven of the 84 styles were not received in time to be included in this report, and 1 style which was received made no claim of satisfying the requirements of ANSI Z41.1; these 8 styles are not included in this report.

The 5 styles which were not selected randomly are noted in the tables with an asterisk (*) and were not included in any statements made about the performance of all available men's safety-toe footwear styles. These styles were selected to provide some information about manufacturers not represented in the random sample.

Test Criteria

Size 9D footwear classified as meeting ANSI Z41.1 are required to withstand a 30, 50,or 75 ft.-lb. impact and an average compressive force of 1000, 1750, or 2500 lbs. without decreasing the internal clearance of the toe box to less than 0.50 inch for Class 30, 50, or 75 respectively.

Testing

Interested parties from OSHA, labor unions, and manufacturers were

invited to attend a meeting at TCB to discuss the procedures used in these tests. All persons in attendance at that meeting agreed on the test procedures used in this test series. All tests were performed in accordance with the requirements of ANSI Z41.1.

Although the ANSI test requirements are very straightforward, the test methods are subject to some degree of interpretation. The impact test consists of dropping a 50-pound weight from a specified height onto a 1-inch diameter steel plunger whose bottom striking surface is rounded to a 1-inch radius. The maximum deflection of the toe box during impact is then determined by measuring the height of a clay cylinder (centered in the toe box beneath the impact zone) at its lowest point. Determination of the lowest height of the clay cylinder is, to some extent, a subjective judgment and therefore subject to some imprecision. ANSI Z41.1 permits the use of wax paper on the ends of the clay piece to prevent the clay piece from sticking to the liner or insole. This technique was tried on a few specimens, but was found to be impractical. The wax paper permitted the clay pieces to move slightly in the toe box and be further deformed when the 50-pound weight bounced on the plunger. Since no "sticking" problems had been encountered in previous tests where wax paper was not used, we decided not to use wax paper in these tests.

The compression test was performed by applying the load to the toe box with a Tinius-Olsen, 12,000 lb., LoCap testing machine. The highest point of the toe box was aligned with the loading axis of the machine,

and the load was then applied at about 50 lb./sec. A 1/2-inch diameter feeler gauge constructed to the dimensions of Figure 2 in ANSI Z41.1 was placed on the insole of each test specimen and moved back and forth under the toe box as the load was applied. The compressive strength of the test specimen is defined by ANSI Z41.1 as the applied load at which the feeler gauge is first prevented from moving with "firm" thumb and finger pressure being exerted on the gauge. The concept of "firm" is very qualitative and may vary widely among individuals. TCB has adopted a procedure which, we feel, provides more reproducible results. This procedure calls for gripping the gauge as tightly as possible between the thumb and forefinger and applying the load to the toe box at about 50 lb./sec. until the gauge slips from between the thumb and finger. This method could be criticized for generating higher test values for compression resistance than would be generated by a method using a "lighter" touch.

Analysis Criteria

Two techniques were used for data analysis. The first technique involved a simple comparison of the test results to the requirements of the standard. Using this technique, no reliable statement can be made about the expected performance of other shoes from a given style. The second technique, utilizing statistical analysis, allows statements to be made about the expected performance of other shoes within a given style. Using the first technique, the styles were

classified as either pass (P) or fail (F).

The statistical treatment of the data, based on the results of the Student t test of the compression test results, allowed classification of each style as either pass (P), fail (F), or indeterminate (I). A classification of "indeterminate" means only that, based on these test results, no definite pass/fail statement can be made about the style in question.

The impact test results were statistically analyzed in a slightly different manner than the compression test results. For each model tested, the question was asked, "Is there at least 95% probability that at least 90% of the shoes in this model would pass the impact test?" The styles were then classified according to the answer to this question as yes (Y) or no (N). It should be noted that an answer of "no" does not mean that a shoe style could not pass the ANSI requirements, but only that, based on these test results, it is not possible to say that at least 9 out of 10 shoes from this style would pass. A more technical statement of the statistical analysis criteria may be found in the Appendix.

An overall rating for both techniques (labeled in the tables as "ANSI" and "stat") was arrived at by examining the test results for each style. The classification of the least favorable test result for a given style determined the overall classification of that style.

RESULTS

General

There does not appear to be any sole material or sole material-toe box combination which offers clearly superior performance when compared with the other combinations. The test results were too scattered or too few styles utilized a given sole material or sole material-toe box combination to allow a performance rating to be made for any of the sole materials or sole material-toe box combinations.

There was no apparent correlation between the sole materials or sole material-toe box combinations and performance test results. For example, for the styles using Chemigum soles and style 250, size 9 toe boxes, the compression test results ranged from 1993.3 to 4330.0 pounds applied force, and the impact test results ranged from 0.410 to 0.656 inch average clearance under a 75 ft.-lb. impact. This indicates that it is not possible to predetermine the expected performance of a given style by knowing the sole material and the toe box used in that style. It is necessary to perform tests on shoes from a given style in order to evaluate its resistance to impact and compressive loads.

We also observed that at least three of the styles tested apparently failed to satisfy the performance requirements (using the ANSI analysis technique) because the toe box burst through the upper material on at least one test specimen during testing.

An examination of the toe boxes used in the footwear revealed some differences in toe boxes used in size 9D footwear. The toe boxes used in 28 styles of the footwear in this test series ranged from size 6 to size 10. Five of those footwear styles used two different toe box sizes and two of those five even used two different toe box models.

Impact

The ANSI analysis technique indicated that 64.0% of the styles tested satisfied the requirements. However, only 37.3% of the styles performed well enough to assure, with 95% certainty, that at least 9 out of 10 of the shoes in that style would satisfy the ANSI requirements. This seemingly large discrepancy between data analysis techniques is caused by the many styles which have average clearances in the impact resistance test only marginally greater than 0.50 inch.

Compression

The ANSI analysis technique indicated that 77.6% of the styles tested satisfied the requirements. The statistical analysis technique indicated that 65.8% of the styles tested would satisfy the requirements of ANSI Z41.1 with 95% certainty. Another 21.1% of the styles were classified as indeterminate. The observed discrepancy between data analysis techniques is caused by those styles which have average applied forces in the compression test only marginally greater than the acceptable level. Closer agreement between the two techniques is to be expected for the compression test than the impact test, since there is no indeterminate rating for the impact test results.

Overall

The ANSI analysis technique showed that 56.6% of the styles satisfied the requirements of both the impact and compression tests. The statistical analysis technique identified 26.3% of the styles as satisfying the requirements of both tests. An additional 6.6% of the styles were classified as indeterminant.

The styles selected by the random sample indicate that only about 57% of the styles available at the time the shoes used in this test series were purchased would be expected to satisfy the requirements of the ANSI standard (as judged by the ANSI analysis technique). We can say with 90% confidence that the true percentage of styles available at that time which would conform to the requirements of the ANSI standard lies between the limits of 47% and 66%. These figures agree quite well with those reported in an earlier NIOSH report.[4]

CONCLUSIONS AND RECOMMENDATIONS

The results of this test series imply that at least 34% of the styles available at the time of this testing would not be expected to satisfy the requirements of ANSI Z41.1. In most cases, the failure is the result of manufacturers making exaggerated claims for their footwear. A shoe which can satisfy the requirements for Class 50, for example, may be labeled Class 75. What we have then, is a relatively large percentage of footwear styles which provide some protection, but less than the manufacturer's label indicates.

It is probable that those parts of the standard which require some interpretation have caused different test results by different laboratories. More strict definitions of the vague portions of ANSI Z41.1 should provide more uniform test results between laboratories. A means of more accurately determining the toe box clearance during impact and compression resistance testing would be the most obvious method of accomplishing that uniformity.

It appears that there is a need for much tighter control of the ANSI classification to insure that footwear labeled as meeting a given ANSI class (Class 30, 50, or 75) does indeed satisfy the requirements of that class. It also appears that tighter control over the actual toe box used in a given style may be desirable to eliminate an additional variable in the performance of that style.

REFERENCES

1. Occupational Safety and Health Standards. Department of Labor, Occupational Safety and Health Administration, Washington, D. C. Standard 29CFR1910. June 17, 1974. 343p.

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4. A Preliminary Investigation of the Performance of Men's Safety-toe Footwear. National Institute for Occupational Safety and Health, Cincinnati, Ohio. HEW Publication No. (NIOSH) 75-132. January 1975. 7p.

5. Experimental Statistics. NBS Handbook No. 91. US Government Printing Office, Washington, D. C. 20402. August 1963.

APPENDIX

Since ANSI Z41.1 calls for a minimum average value for the compression test results and a individual value for the impact test results, two different approaches must be used in statistical analysis of the data.

Impact Test Analysis

Since the ANSI standard states that each piece of footwear tested must satisfy the requirements of the class against which it is being tested, a one-sided tolerance limit of the form

$$X_L = \bar{X} - Ks$$

was calculated for each style tested. The value of K was selected from Table A-7 of reference 5 such that there was 95% probability that at least 90% of the individual impact clearances in a given style would be greater than X_L.

Even though an individual piece of footwear may fail the requirements of the ANSI class it is labeled as meeting, it may still provide a significant amount of protection. Since the failure mode in footwear is usually not an all or nothing type, a 10% rate of individual footwear failure was not considered excessive.

Compression Test Analysis

Since the compression resistance test requirements specify an average force which must be withstood, a different statistical test from that used above must be utilized. The two-sided t test of a hypothesis was used for this analysis. The significance level (α) of the test was

chosen to be 0.10. This choice of α yields 95% confidence in a classification of either pass or fail. The hypotheses were set up in the following format:

$$H_o: m = m_o$$

$$H_a: m \neq m_o$$

where m is the true average applied force for the style being evaluated and m_o is the pass/fail value specified by the standard.

The test statistic has the form

$$T = \frac{\overline{X} - m_o}{s/\sqrt{n}}$$

where $\overline{X}$ is the average value calculated for the style, n is the number of test samples tested in that style, and s is calculated from the formula

$$s^2 = \frac{n \Sigma X_i^2 - (\Sigma X_i)^2}{n\ (n-1)}$$

where X_i represents the individual forces obtained from the test samples.

This analysis technique results in acceptance of the alternate hypothesis (H_a) if either of the following conditions are satisfied

$$T > t_{\alpha/2,n-1}$$

$$T < -t_{\alpha/2,n-1}$$

where $t_{\alpha/2,n-1}$ is the tabulated value of t at the chosen level of confidence $(1-\alpha/2)$ and the degrees of freedom (n-1).

Test samples satisfying the first condition of the previous paragraph were classified as passing (P); those satisfying the second condition were classified as failing (F). If neither of the above conditions were satisfied, the null hypothesis (H_o) had to be accepted and those test samples were classified as indeterminate (I). Section 3.2.1.1 and Table A-4 of reference 5 illustrate the procedures used in this analysis.

Table 1. Results of impact resistance tests on men's safety-toe footwear.

Mfr./Style	ANSI Class	ave. clearance, inch	clearance range, max./min.	std. dev., inch	no. tested	stat. rating, Y/N	ANSI rating, P/F
American Footwear							
8300	75	0.581	0.63/0.45	0.066	6	N	F
8704	75	0.663	0.71/0.63	0.027	6	Y	P
Cedar Crest							
16-6001	75	0.640	0.69/0.59	0.032	6	Y	P
16-3002	50	0.561	0.61/0.47	0.048	6	N	F
Chippewa							
7722	75	0.535	0.57/0.50	0.029	6	N	P
Dorsey							
4700	75	0.682	0.75/0.63	0.043	6	Y	P
7500	75	0.459	0.53/0.39	0.057	6	N	F
888	50	0.617	0.65/0.55	0.034	6	N	P
Goodall							
EB-700*	75	0.522	0.61/0.41	0.071	6	N	F
Hytest							
H-219	75	0.636	0.65/0.61	0.016	6	Y	P
H-237	75	0.568	0.59/0.51	0.029	6	N	P
H-240	75	0.673	0.71/0.65	0.023	6	Y	P
H-325	75	0.551	0.57/0.53	0.012	6	Y	P
H-345	75	0.469	0.50/0.41	0.032	6	N	F
H-404	75	0.591	0.61/0.57	0.012	6	Y	P
H-429	75	0.551	0.57/0.53	0.012	6	Y	P
H-436	75	0.535	0.55/0.51	0.015	6	N	P
H-705	75	0.584	0.63/0.53	0.041	6	N	P
H-723	75	0.591	0.61/0.57	0.018	6	Y	P
H-724	75	0.489	0.53/0.45	0.032	6	N	F

* This style not part of the random survey.

Table 1.--continued

Mfr./Style	ANSI Class	ave. clearance, inch	clearance range, max./min.	std. dev., inch	no. tested	stat. rating, Y/N	ANSI rating, P/F
Hytest							
H-750	75	0.574	0.65/0.53	0.044	6	N	P
H-788	75	0.584	0.63/0.55	0.027	6	Y	P
H-923	75	0.636	0.67/0.61	0.024	6	Y	P
H-937	75	0.564	0.61/0.51	0.032	6	N	P
H-319	30	0.551	0.61/0.51	0.037	6	N	P
Iron Age							
503	75	0.515	0.55/0.41	0.053	6	N	F
641	75	0.325	0.53/0.22	0.139	6	N	F
644	75	0.538	0.61/0.43	0.071	6	N	F
722	75	0.594	0.63/0.55	0.026	6	Y	P
725	75	0.515	0.55/0.50	0.023	6	N	P
918	75	0.459	0.51/0.37	0.068	6	N	F
923	75	0.436	0.47/0.41	0.029	6	N	F
991	75	0.469	0.51/0.41	0.042	6	N	F
Jung							
1805*	75	0.561	0.59/0.51	0.032	6	N	P
1901*	75	0.551	0.57/0.51	0.025	6	N	P
Kaufman							
298*	75	0.650	0.69/0.59	0.041	6	Y	P
Knapp							
K-40	75	0.486	0.51/0.45	0.024	6	N	F
K-75	75	0.558	0.61/0.50	0.049	6	N	P
K-94	75	0.430	0.45/0.39	0.023	6	N	F
K-210	75	0.577	0.61/0.53	0.027	6	N	P

* This style not part of the random survey.

Table 1.--continued

Mfr./Style	ANSI Class	ave. clearance, inch	clearance range, max./min.	std. dev., inch	no. tested	stat. rating, Y/N	ANSI rating, P/F
Knapp							
K-282	75	0.482	0.51/0.43	0.032	6	N	F
K-416	75	0.584	0.63/0.51	0.041	6	N	P
LaCrosse							
3/4 Storm King	75	0.633	0.79/0.51	0.098	6	N	P
LeHigh							
910+	75	-----	---------	-----	---	---	---
1535	75	0.594	0.65/0.51	0.058	6	N	P
1624	75	0.676	0.71/0.65	0.020	6	Y	P
1701	75	0.584	0.61/0.55	0.020	6	Y	P
1783	75	0.545	0.59/0.50	0.039	6	N	P
1910	75	0.715	0.75/0.67	0.032	6	Y	P
1939	75	0.541	0.59/0.47	0.059	4	N	F
1681	50	0.594	0.63/0.57	0.023	6	Y	P
1926	50	0.666	0.71/0.63	0.029	6	Y	P
1945	50	0.568	0.59/0.55	0.015	6	Y	P
On Gard							
656	75	0.669	0.75/0.63	0.048	6	Y	P
699	75	0.604	0.63/0.57	0.020	6	Y	P
725	75	0.486	0.53/0.45	0.037	6	N	F
735	75	0.456	0.51/0.41	0.036	6	N	F
806	75	0.594	0.67/0.41	0.091	6	N	F
944	75	0.656	0.69/0.63	0.020	6	Y	P
974	75	0.538	0.57/0.47	0.034	6	N	F

+ Test results invalid.

Table 1.--continued

Mfr./Style	ANSI Class	ave. clearance, inch	clearance range, max./min.	std. dev., inch	no. tested	stat. rating, Y/N	ANSI rating, P/F
Ranger							
6150	75	0.545	0.59/0.47	0.051	6	N	F
Record Industrial							
1162	75	0.410	0.51/0.31	0.085	6	N	F
1373	75	0.449	0.51/0.35	0.058	6	N	F
1570	75	0.679	0.75/0.59	0.058	6	Y	P
1590	75	0.584	0.67/0.53	0.048	6	N	P
1979	75	0.430	0.50/0.37	0.049	6	N	F
Red Wing							
915	75	0.495	0.55/0.45	0.038	6	N	F
Robar							
4200	75	0.564	0.67/0.51	0.059	6	N	P
4300	75	0.597	0.67/0.55	0.057	6	N	P
Safety First							
1118	75	0.584	0.61/0.55	0.027	6	Y	P
1601	75	0.417	0.45/0.37	0.029	6	N	F
3974	75	0.423	0.45/0.39	0.042	2	N	F
Snyder							
2TV4010	75	0.866	0.89/0.85	0.018	6	Y	P
Thom McAn							
00195*	75	0.659	0.71/0.57	0.054	6	Y	P
00978	75	0.548	0.57.0.51	0.023	6	N	P
Uniroyal							
MB-901-B	75	0.686	0.79/0.61	0.070	6	Y	P

* This style not part of the random survey.

Table 2. Results of compression resistance tests on men's safety-toe footwear.

Mfr./Style	ANSI Class	average force, lbs.	std. dev., lbs.	no. tested	T	stat. rating, P/F/I	ANSI rating P/F
American Footwear							
8300	75	2966.7	135.4	6	8.4	P	P
8704	75	3236.7	202.2	6	8.9	P	P
Cedar Crest							
16-6001	75	3353.3	292.2	6	7.2	P	P
16-3002	50	2040.0	133.6	6	5.3	P	P
Chippewa							
7722	75	3886.7	195.0	6	17.4	P	P
Dorsey							
4700	75	2606.7	281.9	6	0.9	I	P
7500	75	2880.0	105.1	6	8.9	P	P
888	50	3980.0	369.4	6	14.8	P	P
Goodall							
EB-700*	75	3550.0	288.1	6	8.9	P	P
Hytest							
H-219	75	2623.3	190.8	6	1.6	I	P
H-237	75	2913.3	238.6	6	4.2	P	P
H-240	75	2860.0	320.7	6	2.7	P	P
H-325	75	4013.3	269.4	6	13.8	P	P
H-345	75	2006.7	162.3	6	-7.4	F	F
H-404	75	6043.3	346.7	6	25.0	P	P
H-429	75	3863.3	239.1	6	14.0	P	P
H-436	75	4023.3	586.2	6	6.4	P	P
H-705	75	3496.7	137.1	6	17.8	P	P
H-723	75	2563.3	88.9	6	1.7	P	P
H 724	75	2063.3	222.5	6	-4.8	F	F

* This style not part of the random survey.

Table 2.--continued

Mfr./Style	ANSI Class	average force, lbs.	std. dev., lbs.	no. tested	T	stat. rating, P/F/I	ANSI rating, P/F
Hytest							
H-750	75	2626.7	100.1	6	3.1	P	P
H-788	75	2200.0	97.2	6	-7.6	F	F
H-923	75	2910.0	51.8	6	19.4	P	P
H-937	75	2883.3	148.3	6	6.3	P	P
H-319	30	1605.8	96.3	6	15.4	P	P
Iron Age							
503	75	3080.0	164.4	6	8.6	P	P
641	75	2600.0	860.2	6	0.3	I	P
644	75	2870.0	129.5	6	7.0	P	P
722	75	2486.7	161.8	6	-0.2	I	F
725	75	2900.0	86.7	6	11.3	P	P
918	75	4106.7	551.0	6	7.1	P	P
923	75	2290.0	260.7	6	-2.0	I	F
991	75	2960.0	164.0	6	6.9	P	P
Jung							
1805*	75	3940.0	408.5	6	8.6	P	P
1901*	75	3266.7	410.0	6	4.6	P	P
Kaufman							
298*	75	2396.7	291.0	6	-0.9	I	F
Knapp							
K-40	75	2356.7	330.2	6	-1.1	I	F
K-75	75	3243.3	217.0	6	8.4	P	P
K-94	75	2570.0	239.2	6	0.7	I	P
K-210	75	2926.7	379.4	6	2.8	P	P
K-282	75	2756.7	171.8	6	3.7	P	P
K-416	75	3083.3	277.0	6	5.2	P	P

* This style not part of the random survey.

Table 2.--continued

Mfr./Style	ANSI Class	average force, lbs.	std. dev., lbs.	no. tested	T	stat. rating, P/F/I	ANSI rating, P/F
LaCrosse 3/4 Storm King	75	3250.0	245.2	6	7.5	P	P
LeHigh 910	75	2264.2	132.5	6	-4.4	F	F
1535	75	2353.3	214.5	6	-1.7	I	F
1624	75	5043.3	517.3	6	12.0	P	P
1701	75	4190.0	274.4	6	15.1	P	P
1783	75	3066.7	165.2	6	8.4	P	P
1910	75	3783.3	68.6	6	45.8	P	P
1939	75	3520.0	330.1	6	7.6	P	P
1681	50	2134.2	168.2	6	5.6	P	P
1926	50	2043.3	128.9	6	5.6	P	P
1945	50	2129.2	128.9	6	7.2	P	P
On Gard 656	75	5043.3	188.6	6	33.0	P	P
699	75	2240.0	233.2	6	-2.7	F	F
725	75	1775.0	94.2	6	-18.9	F	F
735	75	1673.3	306.4	6	-6.6	F	F
806	75	2280.0	346.6	6	-1.6	I	F
944	75	4330.0	478.1	6	9.4	P	P
974	75	1826.7	169.5	6	-9.7	F	F
Ranger 6150	75	2810.0	282.2	6	2.7	P	P
Record Industrial 1162	75	2706.7	172.4	6	2.9	P	P

Table 2.--continued

Mfr./Style	ANSI Class	average force, lbs.	std. dev., lbs.	no. tested	T	stat. rating, P/F/I	ANSI rating, P/F
Record Industrial							
1373	75	1993.3	126.9	6	-9.8	F	F
1570	75	2746.7	576.6	6	1.0	I	P
1590	75	2746.7	289.5	6	2.1	P	P
1979	75	2273.3	306.6	6	-1.8	I	F
Red Wing							
915	75	3520.0	276.8	6	9.0	P	P
Robar							
4200	75	2546.7	144.6	6	0.8	I	P
4300	75	2926.7	225.8	6	4.6	P	P
Safety First							
1118	75	4180.0	393.3	6	10.5	P	P
1601	75	2556.7	164.6	6	0.8	I	P
3974	75	1816.7	155.6	6	-10.8	F	F
Snyder							
2TV4010	75	4616.7	180.0	6	28.8	P	P
Thom McAn							
00195*	75	3430.0	285.9	6	8.0	P	P
00978	75	2716.7	415.8	6	1.3	I	P
Uniroyal							
MB-901-B	75	3746.7	199.9	6	15.3	P	P

* This style not part of the random survey.

Table 3. Overall ANSI rating of styles.

Mfr./Style	ANSI Class	ANSI rating, P/F
American Footwear		
8300	75	F
8704	75	P
Cedar Crest		
16-6001	75	P
16-3002	50	F
Chippewa		
7722	75	P
Dorsey		
4700	75	P
7500	75	F
888	50	P
Goodall		
EB-700*	75	F
Hytest		
H-219	75	P
H-237	75	P
H-240	75	P
H-325	75	P
H-345	75	F
H-404	75	P
H-429	75	P
H-436	75	P
H-705	75	P
H-705	75	P
H-723	75	P
H-724	75	P
Hytest		
H-319	30	P
H-750	75	P
H-788	75	F
H-923	75	P
H-937	75	P
Iron Age		
503	75	F
641	75	F
644	75	F
722	75	F
725	75	P
918	75	F
923	75	F
991	75	F
Jung		
1805*	75	P
1901*	75	P
Kaufman		
298*	75	F
Knapp		
K-40	75	F
K-75	75	P
K-94	75	F
K-210	75	P
K-282	75	F
K-416	75	P
LaCrosse		
3/4 Storm King	75	P

*This style not part of the random survey.

Table 3.--continued

Mfr./Style	ANSI Class	ANSI rating, P/F
LeHigh		
910	75	F
1535	75	F
1624	75	P
1701	75	P
1783	75	P
1910	75	P
1939	75	F
1681	50	P
1926	50	P
1945	50	P
On Gard		
656	75	P
699	75	P
725	75	P
806	75	F
944	75	P
974	75	F
Ranger		
6150	75	F
Record Industrial		
1162	75	F
1373	75	F
1570	75	P
1590	75	P
1979	75	F
Red Wing		
915	75	F
Robar		
4200	75	P
4300	75	P
Safety First		
1118	75	P
1601	75	F
3974	75	F
Snyder		
2TV4010	75	P
Thom McAn		
00195*	75	P
00978	75	P
Uniroyal		
MB-901-B	75	P

* This style not part of the random survey.

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