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MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED ALUMINUM ALLOY PLATE

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FOREWORD

This investigation was conducted by the Alcoa Research Laboratories, Aluminum Company of America, under USAF Contract No. AF33(657)-7837, Project No. 7381, "Materials Applications", Task No. 738103, "Data Collection and Correlation." The work was under the direction of the AF Materials Laboratory, Research and Technology Division, Wright-Patterson Air Force Base, Ohio, with Mr. Clayton L. Harmsworth as project engineer.

This report covers work done from March 1962 to April 1964.

The investigation was made under the supervision of Mr. G. W. Stickley, with Mr. D. J. Brownhill as project leader. The statistical analyses were made by Mr. W. P. Goepfert, assisted by Mr. J. H. Clouse.

ABSTRACT

The tensile, compressive, shear and bearing properties were determined in the longitudinal and long-transverse directions for a total of 129 lots of commercially produced 2014, 2024, 7075, 7079 and 7178 plate in stress-relieved stretched tempers (-TX51), and in thicknesses from 0.250 to 6.000 in. For thicknesses larger than 2.000 in., tensile and compressive properties were determined in the short-transverse direction.

Tests of 35 lots in "heat-treated-by-user" tempers were made.

Ratios of tensile, compressive, shear and bearing properties to corresponding long-transverse tensile properties were computed. Some variations in ratios occur with respect to alloy, temper, thickness, location in thickness, and direction of loading.

Groups of ratios for each alloy in the -TX51 tempers were analyzed statistically. Minimum-average values were determined. Using these minimum-average values, together with long-transverse tensile properties from specifications as basis "A" values and corresponding basis "B" values obtained from recent production data, tables of design mechanical properties of MIL-HDBK-5 were prepared.

Tensile and compressive stress-strain characteristics were determined. Typical and minimum stress-strain and compressive tangent-modulus curves were prepared for MIL-HDBK-5.

Key Words: 2014, 2024, 7075, 7079, 7178 Aluminum; Tensile, Compressive, Bearing, Shear Properties; Stretched Stress-Relieved.

This technical documentary report has been reviewed and is approved.

D. A. SHINN
Chief, Materials Information Branch
Materials Applications Division
AF Materials Laboratory

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SECTION 1

INTRODUCTION

In the tables of design mechanical properties for aluminum alloys in MIL-HDBK-5, the "A" values for ultimate tensile stress, tensile yield stress and elongation in one direction are the minimum values required in material specifications and are based on the results of considerable number of inspection tests of commercial lots. From past experience, it can be expected that these values will be met by 99 per cent of the total commercial production. Tests for the tensile properties in other directions and for the compressive, shear and bearing properties are seldom, if ever, made during routine inspection; and it would be impractical to provide an equally large amount of data for establishing individually the values for these other properties. For this reason, the "A" design values for these properties are "derived" values based on a smaller number of tests, as described in Paragraph 3.1.1.1.1 of MIL-HDBK-5.

The desirability of stretching heat-treated aluminum alloy products, not only for straightening, but also to reduce residual stresses and warpage during subsequent machining operations, has been recognized in recent years by the establishment of the -TX51 tempers. It is realized, however, that this stretching may have a significant effect on some of the mechanical properties, particularly a reduction of the compressive yield stress in the longitudinal direction. While values for some of the properties not covered by specifications are included in MIL-HDBK-5, it is not certain that all of these values would be the same if they had been established on the statistical basis recommended by the Handbook Reliability Subcommittee of the MIL-HDBK-5 Working Group(1).

The work under this contract was done to establish design mechanical properties, including stress-strain and compressive tangent-modulus curves, for 2014, 2024, 7075, 7079 and 7178 aluminum alloy plate in the relatively new -TX51 tempers. The "derived" values were to be computed using minimum-average ratios determined by statistical analyses of the results of the tests to be made.

The final results of this work are for use eventually in MIL-HDBK-5. For comparison, similar tests were made of a small number of samples of plate in the "heat-treated-by-user" tempers.

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SECTION 2

MATERIAL

All samples of plate tested were from lots produced on regular orders for customers, as they became available; no sample was produced especially for this contract. No two samples were from the same production lot.

The samples were obtained from three producers. While it was planned originally that not more than two-thirds of the samples would be from a single producer, it was not possible to obtain the desired number of samples and also meet this requirement.

Originally, it was planned to procure a sample from each of three to eight lots of 2014, 2024, 7075, 7079 and 7178 aluminum alloy plate in the -TX51 tempers, from each thickness range shown in the tables of design mechanical properties in MIL-HDBK-5, August 1962. The number of samples for each thickness range depended mainly upon the extent of the range. A lesser number of samples of plate also was ordered in the -O or -F temper in most of the thickness ranges, to be heat treated later for tests of the "heat-treated-by-user" tempers.

Actually, not all of the desired samples became available, particularly some of those of the larger thicknesses. A total of 129 samples in the -TX51 tempers, and 31 in the -O or -F temper, were received. They were produced between June 1962 and December 1963, with the exception of a few produced as early as June 1960. The four samples of 2024-O and -F were tested in two "heat-treated-by-user" tempers, so that the total number of samples tested in those tempers really was 35 instead of 31.

Each sample was 15x20 in., except that those of 2024-O and 2024-F were 20x30 in. The latter were cut in half so that the pieces later could be heat treated to the -T42 and -T62 tempers, respectively.

The thicknesses ranged from 0.250 to 6.000 in. The thickness and identification of each sample are shown in Table I.

The heat treatment and stretching conditions used in fabricating the samples of -TX51 plate, as reported by the respective producers, are shown in Table II.

The 31 samples that were received in the -O or -F temper were heat treated to the "heat-treated-by-user" tempers using the conditions shown in Table III, which are generally in accordance with MIL-H-6088C.

SECTION 3

PROCEDURE

All tests were made using the smallest suitable ranges of an Amsler 20,000-lb (Type 10SZBDA58), an Olsen Electomatic 30,000-lb, or a Southwark-Tate-Emery 50,000-lb Universal Testing Machine. Each of these machines had been calibrated prior to and during the life of this contract. The accuracy always was well within that required by ASTM(2) and Federal specifications, generally being within 0.75 per cent for all loads from 1/10 to full range. In all tests, the range used was such that loads at the ultimate stress and yield stress exceeded 1/10 of that range.

Single tests were made except in a few instances where a review of the results indicated that check tests were needed.

Tensile, compressive, shear and bearing tests were made using longitudinal and long-transverse specimens from the center of the thickness of each sample, and midway from the surface to the center of the thickness from all samples thicker than 1.500 in. Tests also were made using short-transverse specimens from all plate 2.000 in. or more in thickness. Bearing specimens were taken in the flatwise plane from each sample, and also in the edgewise plane from some samples of plate 1.000 in. or more in thickness.

The general dimensions of the specimens are shown in Figs. 1, 2 and 3.

The tensile specimens from plate ≤ 0.499 in. thick were full-thickness sheet-type specimens; for plate ≥ 0.500 in. thick, the largest suitable subsize round specimen was used. Generally, the 1/2-in. and 1/4-in. diam tensile specimens were of the tapered-seat type(3), but threaded-end specimens were used in a few tests. The compressive specimens from plate ≤ 0.499 in. thick were full-thickness sheet-type specimens; for plate ≥ 0.500 in. thick, 1/2-in. diam specimens were used. The tensile and compressive tests were conducted in accordance with ASTM Methods E8 and E9(4,5), respectively. Yield stresses were determined from autographic load-strain diagrams at 0.2 per cent offset. The compressive tests were made using a subpress (Fig. 3 of Methods E9), and lateral support in tests of sheet-type specimens was provided by a Montgomery-Templin jig (Fig. 4a of Methods E9).

The largest suitable shear specimen (3/16- or 1/4-in. diam) was used for plate ≤ 0.375 in. thick; for plate > 0.375 in. thick, 3/8-in. diam specimens were used. The tests were made using an Amsler double-shear tool in which the specimens were sheared on two planes one inch apart. The diametral clearance between the shear die and specimen was approximately 0.001 in. to 0.002 in. In the tests, the loads were applied in a direction normal to the surface of the plate from which the specimens were taken. The shear stresses determined in tests with loads applied in this direction average about 5 per cent lower than when loads are applied in a direction parallel to the surface of the plate(6).

For the different orientations of bearing specimens and thicknesses of plate, the following types of specimens (Fig. 3) were tested:

Orientation	Type of Specimen	Plate Thickness, in.
Flatwise	F	0.250-0.315
	D	0.373-6.000
Edgewise	A,B	1.000-1.280
	D	≥ 1.500

As reported previously(7), there is little effect on the values obtained for bearing properties when these different sizes of specimens are used.

In the bearing tests, load-deformation curves were recorded autographically and the bearing yield stresses were determined at an offset equal to 2 per cent of the pin diameter. Edge distances of both 1-1/2 and 2 times the pin diameter were used. The test fixture and the specimens were ultrasonically cleaned in acetone before testing(8).

Modulus-of-elasticity and stress-strain tests of a selected number of samples were made, both in tension and compression, using longitudinal and long-transverse specimens as shown in Fig. 4. For plate ≤ 0.499 in. thick, full-thickness sheet-type tensile and compressive specimens were used; for plate ≥ 0.750 in. thick, 1/2-in. diam tensile and 3/4-in. diam compressive specimens were used.

The procedure in these tests generally was in accordance with ASTM Method E111-61(9). In each test, two or more cycles of load were applied, the maximum load in the first cycle usually being just above the proportional limit. In the first cycle in each tensile test, strains were measured

with an Amsler-Martens mirror-type extensometer over a 6-in. gage length (ASTM Class A)(10). In the final cycle, strains were measured with the same instrument over a 2-in. gage length (ASTM Class B-1)(10), the shorter gage length being used in order to reduce the amount of resetting of the extensometer during measurement of the larger strains. In each cycle in the compressive tests, a Tuckerman optical strain gage was used over gage lengths of 1 in. and 2 in. for sheet-type and round specimens, respectively (ASTM Class A)(10). For the determination of each modulus value, the data were examined by the strain-deviation procedure in Method E111-61 (9).

Based on the results of the stress-strain tests, typical and minimum ("A" value) stress-strain curves of the alloys in the -TX51 tempers, and typical curves for each alloy in the "heat-treated-by-user" tempers, were prepared for various thickness ranges in accordance with Attachment 59-25(a) of the minutes of the 20th meeting of the ANC-5 Panel(11). This method was recommended by the Panel at that meeting.

From the typical and minimum compressive stress-strain curves, corresponding compressive tangent-modulus curves were prepared. To do this, parts of the respective stress-strain curves were replotted using suitably expanded or compressed scales. The stresses at various values of tangent-modulus then were determined, from which the tangent-modulus curves were plotted.

SECTION 4

RESULTS OF TESTS

Summary tables of the results of individual tests, of ratios among some of those results, of statistical analyses of the ratios among certain properties, and of proposed design values are arranged as indicated in the List of Tables. In the first two groups of tables, the samples are arranged in groups according to the thickness ranges in specifications.

Plots of ratios among properties for the samples of different thicknesses of -TX51 tempers are shown in Figs. 5 to 22. The stress-strain and compressive tangent-modulus curves are shown in Figs. 23 to 40.

SECTION 5

DISCUSSION OF RESULTS

The specified minimum values for tensile properties of plate of the different alloys and tempers, as now accepted by the industry, are summarized in Table IV. These are as shown in the Aluminum Association's Booklet, "Standards for Aluminum Mill Products," October 1963 (with one exception as noted in the table), and generally as they are expected to appear in ASTM Specification for Aluminum Alloy Sheet and Plate (B209-64). In the cases where values differ from those shown in the government or AMS specifications now in use, it is understood that the necessary revisions and corrections are being made in those specifications.

The results of the tests of the individual samples, with the exception of the stress-strain tests, are summarized in Tables V to XI. The tensile properties of each sample exceeded the specified minimum values.

Comparison of the properties of samples from the different producers sometimes showed apparent differences. Tests of significance, however, did not indicate definite differences, probably because of the small number of samples from some producers.

The ratios among the tensile, compressive and shear properties of the individual samples are shown in Tables XII to XVIII. Similarly, the ratios between bearing properties and tensile properties are shown in Tables XIX to XXV.

The average values of the ratios of properties in the longitudinal and long-transverse directions and at the specification test location in the thickness, for the respective thickness ranges of the different alloys and tempers, are shown in Tables XXVI to XXX. For the artificially aged tempers, the ratios among some of the properties are distinctly different for the -T651 and -T851 tempers than for the -T6 and -T62 tempers, respectively. In the solution heat treated tempers of 2024 (-T351 and -T42), still larger differences occur, as would be expected.

For comparison, these tables also contain the corresponding ratios as indicated by the design values in MIL-HDBK-5, August 1962. Again, there are distinct differences when the latter ratios are compared with the ratios from the recent tests of both the stress-relieved stretched (-TX51) tempers and the "heat-treated-by-user" tempers (-TX, -TX2). It should be noted that the higher ratios of bearing

properties to tensile properties for the tests made on this contract are at least partly the result of an improved procedure for making bearing tests(8).

In order to use the ratio data for the respective alloys and tempers more effectively, a regression analysis of each group of ratios was made to determine whether a significant correlation exists with thickness. In this manner, advantage was taken of the data across all thicknesses in arriving at the minimum average ratios used for determining derived design values. Where no correlation exists, a single minimum value of $\bar{R}$ was selected to apply to all thicknesses. This value is the lower limit of the confidence band around the average ratio of all the data. Where a significant correlation with thickness does exist, values of minimum $\bar{R}$ for each thickness range were selected that corresponded with the lower limit of the confidence band around the regression line at the mean of each respective thickness range.

These analyses were made of the ratios involving results of longitudinal and long-transverse tests of the different samples of the -TX51 temper of each alloy. Similar analyses were made of the ratios involving results of short-transverse tests of 7075-T651 and 7079-T651 but not of the other alloys and tempers. The distribution of the ratios, and the values for the different terms in the analyses, are shown in Tables XXXI to XXXVI. For the ratios involving tensile ultimate stress and tensile yield stress in the longitudinal and long-transverse directions, there generally is no correlation with thickness; in those ratios involving compressive yield stress, there frequently is a correlation. In the ratios involving tensile and compressive stresses in the short-transverse directions, there are no correlations. In the ratios involving shear and bearing stresses, there is no correlation with thickness for the 2000-series alloys, but there generally is for the 7000-series.

Since shear and bearing tests had been made using both longitudinal and long-transverse specimens, Student's "t"-test was applied for each alloy to the ratios for each test direction, to determine whether there was a significant difference between average ratios for the two directions. Where none was found, the ratios for the two directions were combined for computations establishing the minimum ratio values that would be used; where there was a significant difference, the ratio values used were those for the direction for which the values were more conservative.

The values of ratios for use in computing design values from specified long-transverse tensile properties of the respective thickness ranges of each alloy are summarized in Tables XXXVII to XLII.

Design values for ultimate tensile stress, tensile yield stress, compressive yield stress, ultimate shear stress, ultimate bearing stress and bearing yield stress for the -TX51 tempers of each alloy have been summarized as shown in Tables XLIII to XLVII. In these tables, all differences from values shown in corresponding tables in MIL-HDBK-5, August 1962, are indicated and explained by footnotes.

In preparing these tables, the values for long-transverse tensile properties shown in Table IV were used as basis-property "A" values. For those alloys and thickness ranges for which "B" values for long-transverse tensile properties are shown in MIL-HDBK-5, August 1962, the same values were used except where a review of Alcoa's recent production data indicated definitely that changes should be made. In some cases where the "A" value had been increased, the "B" value was not changed, because the review would not support a higher "B" value. Wherever sufficient supporting production data were available, corresponding "B" values for other thickness ranges were added. Using these basis-property values and the ratios in Tables XXXVII to XLII, the remaining design values, excepting those in the short-transverse direction, were computed.

For 2014-T651, the short-transverse "A" values in MIL-HDBK-5, August 1962, were retained because the number of samples tested in this direction was considered too small to justify statistical determination of minimum-average values for ratios among properties. The short-transverse "B" values were derived using the same spreads between "A" and "B" values as shown for long-transverse tensile properties.

For 7075-T651, the short-transverse "A" values were derived using the basis-property long-transverse values and the ratios in Table XL. The short-transverse "B" values were derived using the same procedure as for 2014-T651. It should be noted that the short-transverse values for 7075-T651 in Table XLV are definitely lower than those in MIL-HDBK-5, August 1962.

When preparing Table XLVI for design properties of 7079-T651 plate, a conflicting situation was found. Specifications for this material contain requirements for tensile properties not only in the long-transverse directions, but also in the longitudinal and short-transverse directions. These values computed using the ratios in Table XLI, however, are different. Such differences may be explained by the fact that the ratios determined from the tests made on this contract are based on a relatively small number of samples. The longitudinal and short-transverse values in specifications no doubt are based on tests of a larger number of samples.

In Tables XLIII to XLVII of design properties, more than half of the values for tensile, compressive and shear properties now shown in MIL-HDBK-5, August 1962, have been changed slightly; and the majority of the changes were decreases. The lower values for shear stress may be explained partly by the fact that the loads in the shear tests, in this investigation, were applied normal to the surface of the plate; in previous tests, the direction of loading was not controlled. All of the bearing values were changed, those changes generally being increases, mainly because of the recent improvements in test procedure. For the larger thickness ranges, many new values for the various properties have been added. In some cases, they involved interpolation or extrapolation, where no samples of those thicknesses had been received for testing; however, this was done only when experience indicated this would be reasonably satisfactory.

The procedure used in calculating the derived values in the tables of design mechanical properties in this report is in accordance with that recommended by the Handbook Reliability Subcommittee(1).

Although not of direct interest in connection with the tables of design mechanical properties in MIL-HDBK-5, some additional observations concerning differences in mechanical properties can be made that are of interest.

The properties at center of thickness often were definitely different from those at midway location, the latter being the location at which specification tensile tests are made in plate thicker than 1.500 in. The ratios for each property at center vs midway locations are summarized in Tables XLVIII and XLIX, and some averages of these ratios are shown in Table L. There appeared to be no correlation between any of the ratios and thickness of plate. For the same tempers of 2014 and 2024, the ratios were about the same; and the same was true for 7075 and 7079. For 2024-T351 and -T42, the ratios for ultimate tensile stress, tensile yield stress and compressive yield stress ranged from 1.03 to 1.10, the range being about the same regardless of temper or direction. The ranges were smaller for the artificially aged tempers of 2014 and 2024, the ratios for the longitudinal direction then averaging about 1.00, and in the long-transverse direction averaging about 0.99. For the artificially aged tempers of 7075 and 7079, the ratios for the longitudinal direction average 1.06, and in the long-transverse direction, 1.02.

The ultimate shear stress always was lower at the center location. The average ratio, 0.93, was about the same regardless of alloy, temper and direction of specimen.

The flatwise bearing properties generally were lower at the center location. For 2024-T351 and -T42, the average ratio was 0.98, the ratios being slightly lower for the smaller than for the larger edge distance. For the artificially aged tempers, regardless of alloy, temper (-TX51 or "heat-treated-by-user"), and edge distance, the ratio was slightly lower, averaging 0.97.

Another comparison that can be made is that of bearing properties of plate 1 in. and thicker, when using edgewise vs flatwise specimens. Ratios for each of these properties are shown in Tables LI and LII; the averages are summarized in Table LIII. The average ratios ranged from 1.01 to 0.86. In general, the ratios were about the same regardless of whether longitudinal or long-transverse specimens were tested; and, in the artificially aged tempers, whether the temper was -TX51 or "heat-treated-by-user." The ratios generally were lower, however, for ultimate bearing stress than for bearing yield stress, for 2024-T351 than for 2024-T42, for 2024 in artificially aged tempers than in solution-heat-treated tempers, for 2000-series alloys than for 7000-series alloys (ultimate bearing stress only), and for an edge distance (e/D) of 1.5 than for 2.0.

The results of the repeated stress-strain tests are summarized in Table LIV and the average modulus values are shown in Table LV.

In the modulus tests, there was a slight difference in average values in the initial and final loading cycles. In tensile loading, the initial value averaged slightly higher (140,000 psi); and in compressive loading, slightly lower (40,000 psi). These differences probably occurred because of residual stresses. The modulus averaged about 100,000 psi higher in the long-transverse than in the longitudinal direction. In 2024, there was no definite difference between the values for the solution-heat-treated and the artificially aged tempers, nor between those for the -TX51 and "heat-treated-by-user" tempers, nor between the alloys within the 2000 or 7000 series. There were definite differences, however, between the average values for the two groups and between those in tension and compression.

The modulus values selected for the alloys and types of loading, rounded off to the nearest 100,000 psi, are:

	Modulus, psi	
Alloy Series	Tensile	Compressive
2000	10,700,000	10,900,000
7000	10,300,000	10,600,000

Three of these values are higher than the values shown in MIL-HDBK-5, August 1962. These new values are used in Tables XLIII to XLVII, and in the stress-strain and tangent-modulus curves in Figs. 23 to 40.

Analysis of the results of the individual stress-strain tests showed that, for a given alloy, temper and direction, there was no trend with thickness in the offsets from the modulus line at stresses expressed in per cent of yield strength in the respective tests. Therefore, knowing the modulus and having the groups of offset values for a stated alloy and temper, longitudinal and long-transverse tensile and compressive stress-strain curves for any alloy and temper can be derived for any desired values of yield stress. Accordingly, typical and minimum ("A" value) curves for the alloys in the -TX51 tempers, and typical curves for the alloys in the "heat-treated-by-user" tempers, have been prepared for various thickness ranges as shown in Figs. 23 to 40. For each typical curve, the long-transverse tensile yield stress was the typical value indicated in Alcoa's production in recent years, and it is assumed that the value for the industry would be about the same. The other yield stresses were computed from this tensile yield stress and the average ratios shown in Tables XXXVIII to XLII.

Only typical curves were prepared for the "heat-treated-by-user" tempers, since the tests of these tempers in this report were not considered sufficient to establish minimum values for yield stresses not included in specifications.

SECTION 6

CONCLUSIONS

Based on the results of tests of commercially produced plate that met the requirements for tensile properties in current specifications, the following conclusions seem warranted concerning the mechanical properties of 2014, 2024, 7075, 7079 and 7178 plate:

1. Average ratios of tensile, compressive and shear properties to the long-transverse tensile properties which are determined in tests required by specifications show that:

   a. For the artificially aged tempers, some of the ratios are distinctly different for the -TX51 tempers than for the "heat-treated-by-user" tempers.

   b. For the solution-heat-treated tempers of 2024, differences in ratios are larger than those for the artificially aged tempers.

2. Minimum-average values of ratios for use in computing design mechanical properties of -TX51 tempers of plate are as shown in Tables XXXVII to XLII. These minimum-average ratios are the lower limits of the confidence bands around the average ratios.

3. For 2014 and 2024 in the -TX51 tempers, these ratios among properties generally are independent of thickness of plate. Exceptions are the ultimate tensile stress of 2014-T651, the yield stresses of 2024-T351 and the compressive yield stresses of 2024-T851.

4. For 7075, 7079 and 7178 in the -TX51 tempers, some of the ratios among properties vary with thickness of plate. These ratios always include ultimate shear stress and bearing yield stress; they sometimes include tensile and compressive yield stresses and ultimate bearing stress; they never include ultimate tensile stress.

5. For each of the alloys in the -TX51 tempers, between the longitudinal and long-transverse

directions, there is no definite difference in the ratios for ultimate shear stress to the long-transverse tensile stresses. The same is true for the ratios involving bearing stresses, with the exception of the ultimate bearing stress of 2024-T351.

6. For plate thicker than 1.500 in., the relations between the mechanical properties at the center of the thickness to those midway from the center to the surface (the location for specification tests) indicate that:

   a. For the respective alloys and tempers, there is no correlation with thickness.

   b. For the same tempers of 2014 and 2024, the percentage differences are about the same; this also is true for 7075 and 7079.

   c. For 2024-T351 and -T42, the ultimate tensile stress, tensile yield stress and compressive yield stress range from 3 to 10 per cent higher at the center, regardless of temper or direction (longitudinal or long-transverse).

   d. For the artificially aged tempers of 2014 and 2024, these properties are about the same at the two locations, regardless of temper or direction.

   e. For the artificially aged tempers of 7075 and 7079, these properties in the longitudinal direction average 6 per cent higher at the center; in the long-transverse direction, 2 per cent higher.

   f. The ultimate shear stress is 7 per cent lower at the center, regardless of alloy, temper and direction of specimen.

   g. The flatwise bearing stresses generally average 2 to 3 per cent lower at the center, regardless of alloy, temper and edge distance.

7. For plate 1 in. and thicker, the bearing stresses generally average from 0 to 14 per cent lower under edgewise than under flatwise loading. The relations are:

a. The percentage differences are about the same whether loading is in the longitudinal or long-transverse direction and, in the artificially aged tempers, whether the temper is -TX51 or "heat-treated-by-user."

b. The differences are larger for ultimate bearing stress than for bearing yield stress, for 2024-T351 than for 2024-T42, for artificially aged tempers of 2024 than for solution-heat-treated tempers, for 2000-series than for 7000-series alloys (ultimate stress only), and for an edge distance of 1.5D than for 2.0D.

8. The modulus of elasticity of each alloy is 2 or 3 per cent higher in compression than in tension. The values are about the same regardless of direction of loading (longitudinal or long-transverse), temper and alloy within the respective series (2000 and 7000).

9. Design values for modulus of elasticity are:

	Modulus, psi	
Alloy Series	Tensile	Compressive
2000	10,700,000	10,900,000
7000	10,300,000	10,600,000

10. Design mechanical properties for the -TX51 tempers of plate as currently produced are as shown in Tables XLIII to XLVII.

11. Typical and minimum ("A" value) stress-strain and compressive tangent-modulus curves for plate as currently produced are as shown in Figs. 23 to 40.

SECTION 7

RECOMMENDATIONS

It is recommended that the tables of design mechanical properties in Tables XLIII to XLVII, and the stress-strain and compressive tangent-modulus curves in Figs. 23 to 40, be used in the next revision of MIL-HDBK-5.

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11. R. L. Templin, E. C. Hartmann and D. A. Paul, "Typical Tensile and Compressive Stress-Strain Curves for Aluminum Alloy 24S-T, Alclad 24S-T, 24S-RT, and Alclad 24S-RT Products," Alcoa Research Laboratories Technical Paper No. 6, 1942.

TABLE I

SAMPLES OF PLATE RECEIVED

2014			2024			7075			7079			7178		
Temper	Thickness, in.	ARL Sample Number	Temper	Thickness, in.	ARL Sample Number	Temper	Thickness, in.	ARL Sample Number	Temper	Thickness, in.	ARL Sample Number	Temper	Thickness, in.	ARL Sample Number
-O	0.312	281364	-O	0.252	281433	-O	0.375	281381	-O	0.252	281422	-O	0.252	281421
	1.001	281366		1.001	281377		1.500	281386		1.001	281388			
	2.500	281547					2.501	281383		3.001	281423	-F	0.250	301880
			-F	0.501	281378		2.522	281418					0.633	301898
-F	0.550	281365		2.001	281372				-F	0.501	281389			
						-F	0.379	301775		1.280	301857	-T651	0.250	252461
-T651	0.250	252458	-T351	0.250	252464		0.625	281382		1.500	301856		0.252	281415
	0.312	281401		0.250	281506*		2.250	281380		1.625	281391		0.276	301835
	0.312	301712†		0.250	301837		3.001	281387		2.250	301858		0.284	301861
	0.314	281485		0.308	301838					2.500	301859		0.312	281501*
	0.500	251757		0.312	281374	-T651	0.314	281404		4.000	301860		0.403	281419
	0.500	281409		0.373	301839		0.375	281509*		4.040	301850		0.435	281483
	0.500	301855		0.375	281375		0.378	301874		4.800	301851		0.435	301733†
	0.642	301891		0.440	281661*		0.420	281636					0.500	251760
	0.756	281518		0.500	251758		0.434	281596	-T651	0.252	281406		0.500	281662*
	1.000	251739		0.501	281370		0.500	270087		0.315	281405		0.504	281416
	1.001	281393		0.505	281659*		0.501	281504*		0.501	281390		0.504	281488
	1.125	281553		0.567	281489		0.504	281414		0.625	281503*		0.520	301734†
	1.500	301844		0.720	281403		0.605	281413		0.750	281675		0.750	281754
	1.501	301652		0.750	281369		0.875	281508*		1.008	281399		1.000	251777
	1.891	281486		0.805	281664*		0.882	281484		1.500	251698		1.000	281657*
	2.000	281656*		1.000	281508*		1.125	281507*		1.635	281410		1.250	251736
	2.001	281580		1.001	281379		1.250	251661		2.000	281500*			
	2.250	281655*		1.009	281487		1.250	281384		2.260	301876			
	2.500	281597		1.015	281510*		1.625	281385		2.500	301877			
				1.250	281373		2.001	281502*		3.000	281842*			
				1.500	251697		2.250	281417		3.000	281554			
				1.980	301845		2.250	281654*		3.001	281392			
				2.000	301819		2.269	281411		3.277	281582			
				2.000	281844*		2.501	301894		4.001	281492			
				2.001	281581		2.501	301897		4.499	281393			
				2.250	281598		2.773	281491		4.770	301879			
				2.250	301782		3.025	281420		6.000	301878			
				2.515	281749		3.953	281684						
				2.800	301848									
				3.000	301846									
			-T851	0.250	252464A									
				0.312	281400									
				0.375	281371									
				0.440	281660*									
				0.499	301853									
				0.500	281753A									
				0.500	281662*									
				0.501	281368									
				0.567	281490									
				0.720	281402									
				0.750	281367									
				0.805	281658*									
				1.001	281376									
				1.009	281511									
				1.260	281412									
				1.500	251697A									
				2.001	281590									
				2.250	281615									
				2.250	301783									
				2.515	281750									

* Samples from Producer B.
† Samples from Producer C.

All others from Producer A.

TABLE II

HEAT TREATMENT AND STRETCHING CONDITIONS
FOR STRESS-RELIEVED STRETCHED PLATE

Alloy and Temper	Producer	Thickness, in.	Solution Heat Treatment* Temperature Range, °F	Stretch, Per Cent	Precipitation Heat Treatment* Temperature Range, °F
2014-T651	A	0.250-2.500	925-945	1-1/2 to 3	315-340
	B	2.000-2.250	925-945	2	330-350
	C	0.312	925-945	1-1/2 to 3	315-340
2024-T351	A	0.250-3.000	910-930	1-1/2 to 3	---
	B	0.250-2.000	910-930	2	---
2024-T851	A	0.250-2.515	910-930	1-1/2 to 3	365-385
	B	0.440-0.805	910-930	2	365-385
7075-T651	A	0.314-3.953	880-900	1-1/2 to 3	240-260
	B	0.375-0.501	880-900	2	200-220; 290-310†
	B	0.875-2.250	880-900	2	240-260
7079-T651	A	0.252-6.000	830-875	1-1/2 to 3	190-210; 240-260†
	B	0.625-3.000	850-875	2	230-250
7178-T651	A	0.250-1.250	860-880	1-1/2 to 3	240-260
	B	0.312-1.000	860-880	2	240-260
	C	0.435-0.520	860-880	1-1/2 to 3	240-260

* Soak times are dependent on thickness but are those that are sufficient to put the heat-treat phase in solution; or, in the case of aging, to achieve required properties.

† Two-step aging treatment.

The temperatures shown are generally within recommended industry standards and within the ranges in MIL-H-6088C.

TABLE III

HEAT TREATMENTS OF -O OR -F PLATE
TO OBTAIN "HEAT-TREATED-BY-USER" TEMPERS

Alloy	Solution Heat Treatment Temperature,† °F	Precipitation Heat Treatment Time‡	Precipitation Heat Treatment Temperature, °F	Final Temper Designation
2014	935	8 hr	350	-T6
2024	920	--	-	-T42
	920	10 hr	375	-T62
7075	890	24 hr	250	-T6
7079	830	5 days RT; 48 hr	240	-T6
7178	875	24 hr	250	-T6

† Soaking time was one hour for thickness ≤ 0.500 in. For each additional 1/2 in. of thickness, 1/2 hr was added.

‡ Time shown was soaking period for thickness ≤ 0.500 in. Except for 7075 and 7178, 1/2 hr was added for each additional 1/2 in. of thickness. For 7075 and 7178, 24 hr was used for thicknesses ≤ 1.500 in.; 35 hr for 1.501-2.000 in.; and 48 hr for ≥ 2.001 in.

TABLE IV

SPECIFIED MINIMUM VALUES* FOR ALUMINUM ALLOY PLATE

Alloy and Temper	Thickness, in.	Direction†	Tensile Ultimate Stress, psi	Tensile Yield Stress,‡ psi	Elongation in 2 in. or 4D, %	Government or AMS Specification
2014-T6, -T651	0.250-0.499	LT	67 000	59 000	7	AMS 4029A
	0.500-1.000	LT	67 000	59 000	6	
	1.001-1.500	LT	67 000	59 000	4	
	1.501-2.000	LT	65 000	59 000	3	
	2.001-3.000	LT	63 000	57 000	2	
	3.001-4.000	LT	59 000§	55 000§	1§	None
2024-T351	0.250-0.499	LT	64 000	40 000	12	QQ-A-355a-1
	0.500-1.000	LT	62 000	41 000**	8	
	1.001-1.500	LT	62 000**	41 000**	7	
	1.501-2.000	LT	61 000**	41 000**	6	
	2.001-3.000	LT	60 000**	41 000**	4	
	3.001-4.000	LT	56 000	40 000	4	None
-T42	0.250-0.499	LT	62 000††	38 000	12	QQ-A-355a-1
	0.500-1.000	LT	61 000††	38 000	8	
	1.001-1.500	LT	60 000	38 000	7	
	1.501-2.000	LT	60 000	38 000	6	
	2.001-3.000	LT	58 000**	38 000	4	
-T62	0.250-0.499	LT	64 000	50 000	5	
	0.500-3.000	LT	63 000	50 000	5	
-T851	0.250-0.499	LT	67 000	58 000	5	
	0.500-1.000	LT	66 000	58 000	5	
	1.001-1.500	—	—	—	—	None
	2.001-3.000	—	—	—	—	None
7075-T6, -T651	0.250-0.499	LT	77 000	66 000	8	QQ-A-283a-1
	0.500-1.000	LT	77 000	66 000	6	
	1.001-2.000	LT	77 000	66 000	4	
	2.001-2.500	LT	73 000	62 000	3	
	2.501-3.000	LT	70 000	60 000	3	
	3.001-3.500	LT	70 000	57 000	3	None
	3.501-4.000	LT	67 000	53 000	2	None
7079-T6, -T651	0.250-1.000	LT	73 000	63 000	8	MIL-A-8877A
	1.001-1.500	LT	73 000	63 000	8	
	1.501-2.000	LT	73 000	63 000	7	
	2.001-2.500	LT	73 000	63 000	6	
	2.501-3.000	LT	71 000	62 000	6	
	3.001-4.000	L	70 000‡‡	60 000‡‡	6‡‡	
		LT	70 000	60 000	5	
		ST	55 000‡‡	56 000‡‡	2‡‡	
	4.001-4.500	L	68 000‡‡	58 000‡‡	6‡‡	
		LT	68 000	58 000	5	
		ST	63 000‡‡	54 000‡‡	2‡‡	
	4.501-5.000	L	68 000‡‡	58 000‡‡	5‡‡	
		LT	68 000	58 000	5	
		ST	63 000‡‡	54 000‡‡	2‡‡	
	5.001-5.500	L	67 000‡‡	57 000‡‡	4‡‡	
		LT	67 000	57 000	4	
		ST	62 000‡‡	53 000‡‡	2‡‡	
	5.501-6.000	L	66 000‡‡	56 000‡‡	4‡‡	
		LT	66 000	56 000	4	
		ST	61 000‡‡	52 000‡‡	2‡‡	
7178-T6, -T651	0.250-0.499	LT	84 000	73 000	8	MIL-A-9180A-1
	0.500-1.000	LT	84 000	73 000	6	
	1.001-1.500	LT	84 000	73 000	4	
	1.501-2.000	LT	80 000	70 000	3	

* Except as noted, all values are as shown in the Aluminum Association's Booklet, "Standards for Aluminum Mill Products," October 1963, respective specifications and those expected to be in ASTM Specification B209-64.

† L, longitudinal; LT, long transverse; ST, short transverse.

‡ Offset equals 0.2 per cent.

§ Not shown in "Standards for Aluminum Mill Products," October 1963.

** Higher than in specification in last column.

†† Lower than in specification in last column.

‡‡ Will not be shown in ASTM Specification B209-64.

TABLE V

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 2014-T651 PLATE

Sample				TENSILE			COMP.	SHEAR	BEARING***							
									Flatwise				Edgewise			
Thickness, in.	Number and Producer	Location*	Direction**	Ultimate Stress, psi	Yield Stress,‡ psi	Elongation in 2 in. or 4D, %	Yield Stress,‡ psi	Ultimate Stress, psi	Ultimate Stress, psi e/D=1.5	Ultimate Stress, psi e/D=2.0	Yield Stress,§ psi e/D=1.5	Yield Stress,§ psi e/D=2.0	Ultimate Stress, psi e/D=1.5	Ultimate Stress, psi e/D=2.0	Yield Stress,§ psi e/D=1.5	Yield Stress,§ psi e/D=2.0
0.250	252458	C	L	69 400	64 300	11.0	63 000	44 100	110 200	139 500	95 300	108 800	—	—	—	—
			LT	69 700	62 600	10.5	66 200	43 700	110 [illegible]	140 100	95 200	110 800	—	—	—	—
0.312	281401	C	L	69 400	65 100	12.5	63 000	42 900	110 [illegible]	144 500	94 900	120 200	—	—	—	—
			LT	70 700	62 900	10.5	66 300	43 000	110 500	144 300	95 300	120 600	—	—	—	—
0.312	301712‡‡‡	C	L	72 800	68 400	10.5	70 100	45 200	117 400	146 500	104 900	123 900	—	—	—	—
			LT	72 000	65 400	9.0	71 900	44 000	117 900	147 700	105 700	125 700	—	—	—	—
0.314	281485	C	L	68 900	63 900	12.5	63 400	44 600	114 900	145 700	100 100	113 700	—	—	—	—
			LT	70 400	62 400	11.0	66 700	43 300	114 900	146 100	100 500	117 300	—	—	—	—
0.500	251757	C	L	69 100	64 600	11.7	61 900	44 400	109 800	141 400	91 200	109 900	—	—	—	—
			LT	69 400	62 600	10.3	65 200	42 400	110 900	141 300	95 700	113 600	—	—	—	—
0.500	281409	C	L	70 100	66 200	12.0	63 200	44 400	112 400	142 000	97 100	113 600	—	—	—	—
			LT	71 900	64 400	10.0	66 600	43 800	113 900	144 300	99 300	116 400	—	—	—	—
0.500	301855	C	L	70 400	66 200	13.0	64 000	45 000	115 300	146 000	100 400	118 600	—	—	—	—
			LT	71 800	64 100	10.0	67 600	44 500	114 700	145 200	101 000	120 300	—	—	—	—
0.642	301891	C	L	67 800	62 500	10.7	59 800	41 200	107 400	137 500	93 800	105 100	—	—	—	—
			LT	68 800	61 600	8.7	64 200	40 500	108 100	138 400	93 200	108 800	—	—	—	—
0.756	281518	C	L	68 100	62 800	10.5	60 300	41 200	103 900	137 300	95 200	115 100	—	—	—	—
			LT	69 100	61 400	9.0	63 900	40 900	105 500	137 100	96 600	112 900	—	—	—	—
1.000	251739	C	L	69 000	63 700	10.2	61 600	41 200	106 800	136 000	91 100	112 300	97 600	124 500	91 000	103 000
			LT	69 500	62 700	8.8	64 600	40 800	104 700	135 200	91 800	112 200	99 100	123 700	91 400	106 000
1.001	281398	C	L	71 300	66 600	10.5	65 000	42 300	110 900	140 800	96 300	114 200	101 600	130 600	96 200	117 900
			LT	71 600	65 300	9.0	67 500	41 200	110 300	140 500	97 700	113 500	99 000	132 500	95 500	115 300
1.125	281553	C	L	71 600	65 900	11.0	64 300	43 500	116 200	146 700	103 000	120 700	104 400	137 000	96 800	118 700
			LT	72 600	65 600	9.0	68 000	41 900	116 800	147 200	104 400	121 400	110 800	138 000	100 000	117 400
1.50[illegible]	301[illegible]	C	L	70 600	64 400	9.5	63 700	40 500	107 200	135 200	94 500	110 100	98 000	127 700	92 700	112 500
			LT	70 000	63 200	8.0	65 200	39 800	107 400	136 800	94 200	112 900	98 000	126 700	91 600	111 500
1.501	301652	M	L	71 300	66 700	9.0	64 200	43 500	115 000	145 200	101 700	119 400	—	—	—	—
			LT	70 300	63 200	9.0	66 500	43 000	114 800	142 900	101 700	116 500	—	—	—	—
		C	L	70 800	65 300	8.0	64 200	39 800	109 200	138 400	94 600	112 700	93 200	127 300	††	115 100
			LT	70 300	63 200	8.5	66 000	38 900	109 900	135 600	96 500	111 200	96 000	128 000	††	115 100
1.891	281486	M	L	68 500	63 400	10.0	61 700	41 600	111 000	141 600	98 600	116 400	—	—	—	—
			LT	68 100	61 [illegible]	10.0	64 400	40 700	103 500	138 800	96 600	115 800	—	—	—	—
		C	L	67 700	61 300	9.0	60 800	39 600	107 200	137 100	96 300	113 500	96 300	124 900	92 700	111 400
			LT	68 200	61 300	8.0	62 800	38 200	107 200	131 900	95 500	112 500	96 400	125 900	92 000	113 500
2.000	281656‡‡	M	L	71 400	65 200	10.0	63 400	42 600	113 100	143 900	102 300	115 100	—	—	—	—
			LT	70 500	63 900	7.5	67 100	42 700	114 300	146 900	102 900	119 300	—	—	—	—
		C	L	73 100	67 200	9.0	65 500	40 200	109 600	139 800	98 700	112 200	99 000	130 900	97 100	114 300
			LT	69 800	63 700	7.5	67 100	40 000	111 100	140 100	100 000	117 100	94 000	123 000	††	112 800
			ST	67 100	61 000	2.0	68 100	—	—	—	—	—	—	—	—	—
2.001	281580	M	L	70 400	67 100	9.5	65 200	44 600	114 100	144 800	102 700	122 100	—	—	—	—
			LT	72 100	66 100	6.0	69 600	43 700	115 100	145 400	103 400	122 100	—	—	—	—
		C	L	71 400	66 500	8.0	65 700	40 700	109 800	139 100	98 400	115 700	—	—	—	—
			LT	70 700	65 000	6.0	67 400	39 800	109 900	140 200	98 400	117 800	—	—	—	—
			ST	66 200	63 500	1.6	68 200	—	—	—	—	—	—	—	—	—
2.250	281655‡‡	M	L	70 900	66 300	9.5	64 000	43 500	111 500§§	143 400§§	100 000§§	116 600§§	—	—	—	—
			LT	70 500	64 700	5.5	67 800	42 500	113 600§§	145 200§§	102 700§§	120 800§§	—	—	—	—
		C	L	73 300	68 000	8.0	65 700	41 200	107 100	139 100	97 100	116 400	—	—	—	—
			LT	69 300	63 400	5.0	67 400	39 800	108 100	133 000	95 400	115 200	—	—	—	—
			ST	66 100	61 000	1.6	67 000	—	—	—	—	—	—	—	—	—
2.500	281597	M	L	70 000	66 000	10.0	62 200	42 400	113 400	143 500	101 600	120 000	—	—	—	—
			LT	70 100	63 700	9.0	65 700	42 300	112 400	142 800	102 000	119 300	—	—	—	—
		C	L	70 900	65 400	8.0	63 900	38 900	107 700	136 400	95 900	113 600	—	—	—	—
			LT	70 200	63 700	7.5	57 000	38 200	107 800	136 100	97 000	114 900	93 500	121 600	90 900	111 500
			ST	65 500	60 500	1.6	56 700	—	—	—	—	—	89 500	118 200	††	111 200

* C, center of thickness; M, midway between center and surface of plate.
‡ Offset equals 0.2 per cent.
§ Offset equals 2 per cent of pin diameter.
** L, longitudinal; LT, long transverse; ST; short transverse.
†† Failed before reaching 2 per cent offset.
‡‡ From Producer B.} All others from Producer A.
‡‡‡ From Producer C.}
§§ Average of two tests; all others, single tests.
*** Specimens and fixtures cleaned ultrasonically in acetone.

TABLE VI

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T351 PLATE

Sample: Thickness, in.	Sample: Number and Producer	Sample: Location*	Sample: Direction**	Tensile: Ultimate Stress, psi	Tensile: Yield Stress,† psi	Tensile: Elongation in 2 in. or 4D, %	Comp. Yield Stress,† psi	Shear Ultimate Stress, psi	Bearing***: Flatwise: Ultimate Stress, psi: e/D=1.5	Bearing***: Flatwise: Ultimate Stress, psi: e/D=2.0	Bearing***: Flatwise: Yield Stress,† psi: e/D=1.5	Bearing***: Flatwise: Yield Stress,† psi: e/D=2.0	Bearing***: Edgewise: Ultimate Stress, psi: e/D=1.5	Bearing***: Edgewise: Ultimate Stress, psi: e/D=2.0	Bearing***: Edgewise: Yield Stress,† psi: e/D=1.5	Bearing***: Edgewise: Yield Stress,† psi: e/D=2.0
0.250	252464	C	L	71 000	56 600	18.5	45 000	43 600	110 400	137 400	91 000	101 200	—	—	—	—
			LT	69 400	57 400	16.8	52 400	42 800	112 800	138 400	84 300	105 700	—	—	—	—
0.250	281506**	C	L	73 500	54 600	20.0	45 500	43 300	109 200	134 600	84 500	102 100	—	—	—	—
			LT	72 100	56 800	19.0	51 800	45 200	111 200	137 200	85 [illegible]	105 300	—	—	—	—
0.250	301837	C	L	70 700	54 400	18.5	45 700	43 800	106 800	133 300	85 [illegible]	101 500	—	—	—	—
			LT	68 500	54 800	20.0	46 900	43 800	105 800	130 900	85 400	103 600	—	—	—	—
0.308	301838	C	L	69 400	54 200	21.0	44 800	43 000	105 500	127 700	86 300	102 900	—	—	—	—
			LT	68 400	54 600	20.0	46 400	43 500	104 700	130 900	87 900	106 300	—	—	—	—
0.312	281374	C	L	70 700	54 900	19.0	45 100	44 000	108 900	133 900	88 500	98 100	—	—	—	—
			LT	68 700	55 700	19.0	46 900	43 600	111 200	137 000	88 500	100 300	—	—	—	—
0.373	301839	C	L	68 600	55 400	20.0	45 300	43 500	104 300	126 600	81 400	96 400	—	—	—	—
			LT	67 800	55 800	18.5	45 900	43 000	105 100	129 [illegible]	80 700	99 300	—	—	—	—
0.375	281375	C	L	70 700	55 800	18.5	46 300	44 900	108 600	128 900	86 800	101 900	—	—	—	—
			LT	69 400	55 500	19.0	45 300	43 500	111 000	130 500	86 800	102 700	—	—	—	—
0.440	281661**	C	L	72 700	54 200	20.5	45 700	43 200	110 200	136 400	88 100	102 300	—	—	—	—
			LT	71 000	54 700	19.5	52 700	45 300	108 800	136 000	86 200	103 100	—	—	—	—
0.500	251758	C	L	70 000	54 400	21.1	43 700	43 600	105 000	129 100	81 700	96 800	—	—	—	—
			LT	68 400	54 000	19.7	49 500	44 000	107 500	131 400	86 500	99 300	—	—	—	—
0.501	281370	C	L	69 900	54 800	19.0	45 100	43 500	103 600	126 500	82 400	96 500	—	—	—	—
			LT	68 900	56 400	18.0	49 800	43 300	105 000	131 400	86 600	100 000	—	—	—	—
0.505	281669**	C	L	69 200	56 000	21.0	44 900	43 000	104 000	131 500	86 500	100 600	—	—	—	—
			LT	68 800	56 400	17.0	51 800	44 600	105 000	130 400	86 800	100 000	—	—	—	—
0.567	281489	C	L	69 800	55 400	20.0	45 600	45 500	105 000	129 600	80 600	98 200	—	—	—	—
			LT	68 800	55 800	20.8	45 700	46 200	106 800	129 000	81 900	98 800	—	—	—	—
0.720	281403	C	L	67 100	56 800	21.5	41 700	41 200	105 500	129 300	79 700	94 600	—	—	—	—
			LT	66 400	55 800	19.0	48 800	41 100	106 600	134 200	81 900	99 100	—	—	—	—
0.750	281369	C	L	67 300	54 100	19.5	41 100	41 900	103 500	126 600	82 400	94 700	—	—	—	—
			LT	67 500	55 100	18.5	48 800	41 400	105 200	128 000	81 600	97 500	—	—	—	—
0.805	281664**	C	L	68 800	55 900	18.0	44 500	40 200	102 000	124 700	81 700	95 200	—	—	—	—
			LT	69 400	56 100	17.0	51 900	39 700	104 800	130 100	85 100	99 300	—	—	—	—
1.000	281508**	C	L	74 900	63 800	13.5	52 200	46 000	108 200	131 000	89 800	105 600	—	—	—	—
			LT	70 300	54 200	13.5	59 400	39 100	106 700	131 800	89 500	107 200	—	—	—	—
1.001	281379	C	L	71 700	54 400	18.5	45 500	46 000	104 900	123 100	78 600	95 700	—	—	—	—
			LT	70 500	57 800	17.0	53 100	39 700	105 000	127 900	76 400	95 000	—	—	—	—
1.009	281487	C	L	70 200	54 000	18.5	44 100	39 400	98 700	124 400	78 800	98 300	94 600	119 000	79 400	96 200
			LT	70 100	54 900	16.5	51 100	39 200	108 900	133 900	81 900	99 900	101 900	127 800	79 200	94 300
1.015	281510**	C	L	71 900	60 100	15.0	50 [illegible]	38 900	102 600	127 700	84 300	101 400	92 100	129 100	86 100	103 200
			LT	68 800	57 600	15.0	56 400	38 500	104 800	128 700	83 800	103 700	94 900	123 400	82 500	99 400
1.250	281373	C	L	70 800	58 500	19.0	44 700	40 500	104 800	127 300	79 500	93 800	98 400	125 800	81 500	97 100
			LT	70 300	58 500	17.0	51 100	39 600	108 000	129 300	81 000	97 300	92 900	122 200	77 500	95 900
1.500	251697	C	L	69 400	53 000	19.5	44 000	41 600	101 100	129 600	81 200	97 600	88 100	119 700	79 300	91 400
			LT	68 400	47 400	17.2	50 000	40 300	104 300	130 700	81 000	96 600	91 800	117 500	79 300	92 500

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TABLE VI (CONCLUDED)

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T351 PLATE

Sample: Thickness, in.	Sample: Number and Producer	Location*	Direction**	TENSILE: Ultimate Stress, psi	TENSILE: Yield Stress,† psi	TENSILE: Elongation in 2 in. or 4D, %	COMP. Yield Stress,† psi	SHEAR Ultimate Stress, psi	BEARING*** Flatvise: Ultimate Stress, psi e/D=1.5	Flatvise: Ultimate Stress, psi e/D=2.0	Flatvise: Yield Stress,† psi e/D=1.5	Flatvise: Yield Stress,† psi e/D=2.0	Edgewise: Ultimate Stress, psi e/D=1.5	Edgewise: Ultimate Stress, psi e/D=2.0	Edgewise: Yield Stress,† psi e/D=1.5	Edgewise: Yield Stress,† psi e/D=2.0
1.980	301845	M	L	68 700	52 300	17.5	42 400	42 300	104 800	129 100	81 700	98 200	—	—	—	—
			LT	67 600	45 900	16.5	49 700	42 100	106 800	130 700	81 700	100 900	—	—	—	—
		C	L	70 400	54 300	15.0	45 900	39 100	101 100	124 700	78 800	95 200	87 800	115 600	77 400	93 800
			LT	70 000	48 900	14.5	51 300	38 900	102 800	124 700	78 100	95 200	91 500	115 300	76 000	93 000
			ST	61 600	44 300	6.0	51 700	—	—	—	—	—	—	—	—	—
2.000	301819	M	L	69 500	52 600	18.5	43 400	42 700	101 700	125 000	79 500	93 600	—	—	—	—
			LT	68 200	46 200	14.0	43 800	42 100	105 700	128 400	81 400	98 600	—	—	—	—
		C	L	70 700	53 700	15.0	44 800	38 600	98 300	123 300	77 100	93 900	87 700	117 400	75 300	92 100
			LT	70 800	49 700	14.0	50 600	38 200	102 600	126 600	76 100	96 400	89 400	114 300	73 900	92 100
			ST	59 800	43 500	6.0	51 100	—	—	—	—	—	—	—	—	—
2.000	2818444	M	L	69 500	55 000	18.5	43 000	43 800	104 000	126 200	81 200	96 800	—	—	—	—
			LT	68 400	55 900	13.5	48 400	41 300	103 400	125 700	81 900	98 300	—	—	—	—
		C	L	73 800	55 700	16.0	46 300	39 000	100 000	123 400	78 400	94 600	86 200	113 800	76 100	96 500
			LT	68 300	47 200	13.5	50 500	38 500	102 000	124 600	79 100	96 000	87 400	112 400	75 600	91 000
			ST	57 300	42 500	5.0	50 300	—	—	—	—	—	—	—	—	—
2.001	281581	M	L	70 200	53 500	17.5	43 300	43 000	104 000	128 700	84 300	101 400	—	—	—	—
			LT	68 800	46 400	14.0	45 700	41 900	103 100	131 400	86 400	103 600	—	—	—	—
		C	L	70 800	54 800	17.0	45 100	40 000	103 200	127 200	83 300	99 900	—	—	—	—
			LT	68 300	49 300	13.0	51 600	38 400	103 700	127 400	82 100	97 900	—	—	—	—
			ST	57 100	44 000	3.6	50 600	—	—	—	—	—	—	—	—	—
2.250	281598	M	L	68 800	50 500	20.5	41 500	40 600	104 300	128 700	80 400	96 400	—	—	—	—
			LT	66 800	43 700	17.0	47 200	39 700	104 900	127 700	81 400	97 100	—	—	—	—
		C	L	69 400	52 200	19.5	43 300	38 500	100 900	122 000	81 200	96 400	—	—	—	—
			LT	65 500	42 800	15.0	48 200	36 000	98 100	122 400	75 100	92 200	—	—	—	—
			ST	58 300	43 100	7.0	47 900	—	—	—	—	—	—	—	—	—
2.250	301782	M	L	69 900	55 600	16.0	43 700	42 100	105 300	127 400	82 900	101 400	—	—	—	—
			LT	68 300	47 900	15.5	51 000	41 900	103 800	129 400	84 700	102 100	—	—	—	—
		C	L	75 900	58 600	15.0	48 700	38 800	102 900	128 600	80 400	97 900	94 300	118 300	76 400	96 000
			LT	72 700	52 900	12.5	53 600	37 500	102 300	123 900	81 000	99 400	93 100	118 000	76 100	94 300
			ST	61 300	45 300	4.0	53 400	—	—	—	—	—	—	—	—	—
2.515	281749	M	L	66 800	52 600	13.0	45 600	40 800	101 700	127 600	80 500	94 800	—	—	—	—
			LT	66 400	47 900	10.0	51 000	39 300	99 400	124 900	80 000	97 900	—	—	—	—
		C	L	71 900	54 900	11.0	46 900	37 600	94 800	124 700	77 600	99 100	84 800	114 400	76 100	94 100
			LT	68 300	49 400	11.0	50 500	37 700	99 700	125 100	82 100	100 700	90 500	120 400	75 400	93 400
			ST	58 200	42 400	5.0	51 000	—	—	—	—	—	—	—	—	—
2.800	301848	M	L	66 500	50 400	18.0	41 400	41 900	101 700	125 000	80 500	96 500	—	—	—	—
			LT	67 200	46 400	16.0	46 200	41 400	103 400	125 600	81 400	97 500	—	—	—	—
		C	L	72 700	55 100	13.0	47 900	38 100	102 300	121 000	81 000	97 600	93 800	118 200	76 300	93 800
			LT	69 800	47 600	12.5	51 800	38 900	102 000	124 700	81 700	98 700	93 800	117 300	77 100	93 800
			ST	61 800	41 700	7.0	51 000	—	—	—	—	—	—	—	—	—
3.000	301846	M	L	68 400	53 600	14.5	43 400	41 400	100 600	121 600	81 700	96 600	—	—	—	—
			LT	65 400	45 900	13.5	48 900	41 600	101 400	123 400	82 400	99 400	—	—	—	—
		C	L	67 700	53 800	10.5	45 900	37 100	96 000	117 600	78 100	96 300	90 100	112 400	74 600	90 900
			LT	67 100	48 400	9.0	50 700	38 800	99 000	123 300	77 400	96 600	82 100	105 100	73 200	90 900
			ST	57 400	45 200	5.0	51 200	40 300	—	—	—	—	—	—	—	—

* C, center of thickness; H, midway between center and surface of plate. † Offset equals 2 per cent of pin diam. †† From Producer B; all others from Producer A.
‡ Offset equals 0.2 per cent. ** L, longitudinal; LT, long transverse; ST, short transverse. *** Specimens and fixtures cleaned ultrasonically in acetone.

TABLE VII

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T351 PLATE

Sample Thickness, in.	Sample Number and Producer	Location*	Direction**	TENSILE Ultimate Stress, psi	TENSILE Yield Stress,‡ psi	TENSILE Elongation in 2 in. or 4D, %	COMP. Yield Stress,‡ psi	SHEAR Ultimate Stress, psi	BEARING*** Flatwise Ultimate Stress, psi e/D=1.5	BEARING*** Flatwise Ultimate Stress, psi e/D=2.0	BEARING*** Flatwise Yield Stress,§ psi e/D=1.5	BEARING*** Flatwise Yield Stress,§ psi e/D=2.0	BEARING*** Edgewise Ultimate Stress, psi e/D=1.5	BEARING*** Edgewise Ultimate Stress, psi e/D=2.0	BEARING*** Edgewise Yield Stress,§ psi e/D=1.5	BEARING*** Edgewise Yield Stress,§ psi e/D=2.0
0.250	252464A	C	L	72 900	67 200	9.0	66 700	41 100	113 200	143 800	102 400	123 600	—	—	—	—
			LT	72 600	66 700	[illegible]	67 800	40 300	113 200	143 300	101 700	124 600	—	—	—	—
0.312	281400	C	L	71 400	[illegible]	[illegible]	65 000	41 300	109 300	139 700	96 500	120 100	—	—	—	—
			LT	70 500	[illegible]	[illegible]	66 100	41 000	109 700	137 900	96 500	119 700	—	—	—	—
0.375	281371	C	L	72 500	67 200	[illegible]	66 900	41 000	113 100	142 000	104 400	118 500	—	—	—	—
			LT	72 100	68 700	[illegible]	68 800	41 300	112 700	141 400	102 500	119 500	—	—	—	—
0.440	281660‡‡	C	L	77 000	73 100	10.0	75 300	41 500	130 600	153 900	110 300	124 300	—	—	—	—
			LT	76 900	72 200	6.0	72 400	41 700	119 600	150 700	110 200	125 800	—	—	—	—
0.499	301353	C	L	71 600	66 200	11.0	68 000	41 700	105 100	136 500	97 500	114 500	—	—	—	—
			LT	71 600	65 700	[illegible]	66 500	41 300	107 400	135 200	97 300	111 500	—	—	—	—
0.500	281759	C	L	71 400	66 500	5.0	67 400	42 500	105 500	144 000	[illegible]	117 900	—	—	—	—
			LT	71 000	[illegible]	[illegible]	65 200	42 300	110 100	145 300	101 600	120 700	—	—	—	—
0.500	281662‡‡	C	L	74 100	71 500	10.0	70 700	43 700	114 400	146 000	105 000	120 700	—	—	—	—
			LT	73 200	[illegible]	7.0	71 900	[illegible]	[illegible]	[illegible]	105 100	118 600	—	—	—	—
0.501	281363	C	L	[illegible]	[illegible]	10.0	[illegible]	41 800	106 500	136 900	94 600	113 000	—	—	—	—
			LT	[illegible]	[illegible]	[illegible]	[illegible]	41 400	107 700	136 300	95 100	111 300	—	—	—	—
0.567	281490	C	L	[illegible]	[illegible]	[illegible]	[illegible]	41 100	107 300	[illegible]	99 100	117 100	—	—	—	—
			LT	71 500	[illegible]	[illegible]	67 000	40 600	[illegible]	136 700	98 900	115 500	—	—	—	—
0.720	281402	C	L	69 700	[illegible]	[illegible]	[illegible]	40 500	[illegible]	134 500	96 600	112 200	—	—	—	—
			LT	70 200	[illegible]	[illegible]	[illegible]	40 400	107 200	[illegible]	97 100	113 000	—	—	—	—
0.750	281367	C	L	70 700	[illegible]	[illegible]	[illegible]	41 200	107 000	137 400	92 700	112 400	—	—	—	—
			LT	70 500	[illegible]	[illegible]	[illegible]	40 500	106 900	136 000	96 400	110 700	—	—	—	—
0.805	281658‡‡	C	L	71 600	[illegible]	[illegible]	68 600	40 900	109 600	139 700	100 700	117 100	—	—	—	—
			LT	71 300	67 600	[illegible]	68 000	40 500	103 000	137 400	100 600	116 400	—	—	—	—
1.001	281776	C	L	71 300	64 800	9.0	64 500	40 300	106 200	134 900	93 500	111 000	—	—	—	—
			LT	70 300	[illegible]	[illegible]	64 000	39 600	105 700	133 300	94 100	109 200	—	—	—	—
1.009	281511	C	L	71 700	66 800	[illegible]	67 200	40 100	108 600	[illegible]	99 100	114 900	96 500	125 800	††	116 100
			LT	71 000	66 000	7.0	67 100	39 600	[illegible]	137 100	98 400	114 900	93 400	126 900	††	114 200
1.260	281412	C	L	71 000	[illegible]	[illegible]	[illegible]	40 000	107 400	136 900	97 300	113 800	94 300	124 700	93 700	117 100
			LT	70 400	[illegible]	6.5	[illegible]	40 200	106 500	134 900	96 800	112 200	94 600	127 700	94 300	116 200
1.500	281697A	C	L	[illegible]	[illegible]	[illegible]	[illegible]	40 500	104 300	136 400	92 500	111 000	92 100	122 900	91 600	111 800
			LT	69 300	[illegible]	[illegible]	[illegible]	40 200	107 700	137 600	95 900	110 100	89 500	122 400	††	108 800
2.001	281590	M	L	71 300	65 700	[illegible]	63 500	40 900	110 900	141 500	102 000	119 300	—	—	—	—
			LT	70 800	[illegible]	3.3	[illegible]	41 800	110 100	140 000	101 400	117 900	—	—	—	—
		C	L	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	105 200	133 300	97 700	[illegible]	—	—	—	—
			LT	[illegible]	[illegible]	6.0	[illegible]	39 300	109 300	137 900	110 600	115 700	—	—	—	—
			ST	[illegible]	[illegible]	[illegible]	66 200	—	—	—	—	—	—	—	—	—
2.250	281615	M	L	[illegible]	[illegible]	[illegible]	[illegible]	39 200	107 200	135 300	97 700	114 900	—	—	—	—
			LT	[illegible]	61 900	6.5	62 800	38 800	106 300	132 700	97 900	110 700	—	—	—	—
		C	L	66 800	61 100	[illegible]	61 100	36 900	101 400	127 900	92 000	109 200	—	—	—	—
			LT	66 100	[illegible]	6.5	61 100	36 500	99 600	129 300	92 000	[illegible]	—	—	—	—
			ST	[illegible]	[illegible]	[illegible]	63 500	—	—	—	—	—	—	—	—	—
2.250	301783	M	L	[illegible]	62 300	7.5	[illegible]	40 000	106 400	136 600	95 700	112 900	—	—	—	—
			LT	[illegible]	63 000	7.0	62 400	40 300	107 400	137 100	95 700	114 600	—	—	—	—
		C	L	[illegible]	61 400	[illegible]	[illegible]	37 900	104 600	133 100	93 600	110 000	88 100	120 600	††	[illegible]
			LT	[illegible]	[illegible]	6.0	63 100	36 700	105 100	132 700	94 300	112 400	88 900	116 600	††	108 800
			ST	[illegible]	[illegible]	2.0	[illegible]	—	—	—	—	—	—	—	—	—
2.515	281750	M	L	[illegible]	[illegible]	7.5	60 300	40 200	104 400	135 700	94 500	113 600	—	—	—	—
			LT	[illegible]	[illegible]	6.0	62 900	39 400	103 400	134 900	95 200	112 900	—	—	—	—
		C	L	[illegible]	61 500	7.0	63 100	[illegible]	100 400	133 100	91 400	111 400	86 800	120 400	††	112 200
			LT	[illegible]	[illegible]	6.0	[illegible]	38 100	101 100	133 800	91 600	114 300	86 900	120 900	††	110 700
			ST	64 800	61 300	2.0	65 500	—	—	—	—	—	—	—	—	—

* C, center of thickness; M, midway between center and surface of plate.
‡ Offset equals 0.2 per cent.
§ Offset equals 2 per cent of pin diameter.
** L, longitudinal; LT, long transverse; ST, short transverse.
†† Failed before reaching 2 per cent offset.
‡‡ From Producer B; all others from Producer A.
*** Specimens and fixtures cleaned ultrasonically in acetone.

TABLE VIII

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 7075-T651 PLATE

Sample				TENSILE			COMP.	SHEAR	BEARING***							
									Flatwise				Edgewise			
									Ultimate Stress, psi		Yield Stress,§ psi		Ultimate Stress, psi		Yield Stress,§ psi	
Thickness, in.	Number and Producer	Location*	Direction**	Ultimate Stress, psi	Yield Stress,† psi	Elongation in 2 in. or 4D, %	Yield Stress,† psi	Ultimate Stress, psi	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0
0.314	281404	C	L	83 600	77 200	15.0	74 600	49 500	131 600	167 200	113 300	137 100	—	—	—	—
			LT	84 600	73 800	14.0	78 300	49 400	134 000	167 500	116 200	143 300	—	—	—	—
0.375	281505**	C	L	84 900	77 900	10.0	76 400	47 200	130 500	165 400	112 800	131 500	—	—	—	—
			LT	83 700	74 200	10.5	81 900	46 400	128 900	152 100	109 800	132 300	—	—	—	—
0.378	301874	C	L	85 100	76 100	14.5	76 200	52 200	130 400	162 800	115 100	126 400	—	—	—	—
			LT	84 700	74 900	13.5	81 000	51 500	130 400	164 600	114 300	131 400	—	—	—	—
0.420	281636	C	L	91 500	74 700	13.0	72 300	49 700	120 800	159 100	105 600	128 600	—	—	—	—
			LT	82 400	72 500	12.5	77 000	48 700	124 000	158 000	107 600	130 600	—	—	—	—
0.434	281596	C	L	85 400	79 600	14.5	77 900	50 500	134 500	167 100	120 000	141 500	—	—	—	—
			LT	86 000	75 300	13.5	81 500	49 800	134 300	165 400	120 000	140 000	—	—	—	—
0.500	270087	C	L	91 300	84 000	12.0	78 800	50 600	131 900	167 200	117 100	135 800	—	—	—	—
			LT	90 400	81 000	12.0	83 500	48 300	136 300	158 300	114 300	137 900	—	—	—	—
0.501	281504**	C	L	85 500	78 100	11.0	75 500	48 600	126 300	158 600	110 700	128 600	—	—	—	—
			LT	84 400	74 900	11.0	80 400	47 200	128 600	157 000	110 700	132 100	—	—	—	—
0.504	281414	C	L	89 400	83 100	12.0	79 800§§	50 500	130 500	162 400	113 000	132 100	—	—	—	—
			LT	89 200	80 200	12.0	84 500	49 400	133 300	156 500	114 400	136 300	—	—	—	—
0.605	281413	C	L	89 200	82 400	12.0	79 100	50 900	132 600	160 800	112 800	131 500	—	—	—	—
			LT	89 700	79 000	10.7	83 500	50 300	136 900	155 500	117 200	134 900	—	—	—	—
0.875	281509**	C	L	85 300	78 500	12.0	77 100	48 000	129 200	160 700	113 000	132 100	—	—	—	—
			LT	84 600	74 800	11.0	79 800	46 900	126 300	150 700	107 800	127 200	—	—	—	—
0.882	281484	C	L	87 700	79 800	12.0	76 800	48 600	128 700	158 000	112 900	132 100	—	—	—	—
			LT	86 300	76 400	11.5	81 200	46 800	132 200	158 300	114 200	135 800	—	—	—	—
1.125	281507**	C	L	81 900	75 [illegible]	12.5	71 900	47 600	122 300	157 100	108 000	125 400	114 700	152 500	110 300	132 800
			LT	82 000	72 [illegible]	10.5	77 600	47 200	123 900	153 700	108 700	128 600	115 600	152 500	109 100	131 900
1.250	251661	C	L	90 900	82 100	10.0	80 700	48 500	126 000	160 300	112 300	129 900	106 700	147 900	††	129 600
			LT	88 000	78 800	10.0	82 600	47 700	129 200	152 400	111 600	132 800	111 800	146 600	107 700	130 500
1.250	281384	C	L	88 000	81 000	11.0	78 000	48 500	126 300	155 100	110 800	130 000	119 300	155 400	110 100	134 200
			LT	86 100	76 700	11.5	82 000	47 100	132 200	154 400	114 300	134 900	120 900	152 800	108 000	130 700
1.625	281385	M	L	84 300	77 700	10.0	74 000§§	51 900	133 700	162 100	117 100	132 900	—	—	—	—
			LT	84 000	73 700	9.5	79 000§§	50 900	133 800	161 000	117 900	135 600	—	—	—	—
		C	L	88 200	80 800	9.0	77 400§§	46 200	126 300	154 000	113 700	130 600	111 700	147 900	108 600	129 300
			LT	87 400	78 200	9.0	82 400	46 200	127 900	153 400	110 700	134 300	112 600	142 300	107 200	129 200
2.001	281502**	M	L	80 400	72 100	11.5	71 200	48 500	124 400	157 300	110 600	128 600	—	—	—	—
			LT	80 200	69 400	10.0	74 200	46 300	127 300	160 300	112 800	132 200	—	—	—	—
		C	L	84 100	74 800	10.5	73 500	46 300	125 000	156 300	113 500	127 900	112 900	148 000	104 900	127 900
			LT	80 500	70 200	10.5	74 600	45 100	124 400	155 100	109 400	130 000	113 600	144 300	103 700	125 000
				76 500	66 200	4.6	74 100	—	—	—	—	—	—	—	—	—
2.250	281417	M	L	79 500	74 000	13.5	70 900§§	50 200§§	133 100	159 100	112 100	130 000	—	—	—	—
			LT	80 800	73 800	10.5	77 700§§	49 500	130 700	160 900	114 900	134 300	—	—	—	—
		C	L	83 300	77 400	10.0	75 000§§	47 200	122 400	154 700	108 000	125 000	113 100	143 800	105 900	120 100
			LT	82 100	72 300	10.0	78 200	45 900	127 700	154 500	112 300	132 100	111 500	144 500	103 700	125 700
				77 900	67 100	4.0	77 200	—	—	—	—	—	—	—	—	—

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TABLE VIII (CONCLUDED)

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 7075-T651 PLATE

Sample				TENSILE			COMP.	SHEAR	BEARING***							
									Flatwise				Edgewise			
									Ultimate Stress, psi		Yield Stress,§ psi		Ultimate Stress, psi		Yield Stress,§ psi	
Thickness, in.	Number and Producer	Location*	Direction**	Ultimate Stress, psi	Yield Stress,† psi	Elongation in 2 in. or 4D, %	Yield Stress,† psi	Ultimate Stress, psi	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0
2.250	281654‡‡	M	L	82 400	73 200	10.5	68 300	49 900	126 100	155 100	112 200	131 400	—	—	—	—
			LT	81 300	69 800	10.0	75 700	49 900	124 700	156 200	112 200	132 100	—	—	—	—
		C	L	85 000	76 400	10.5	73 300	47 100	123 600	154 800	110 800	128 600	113 900	147 200	106 500	127 100
			LT	86 700	78 000	9.5	77 600	46 500	125 100	156 500	111 600	130 800	115 800	151 400	106 500	127 800
			ST	76 400	65 200	4.4	76 200	—	—	—	—	—	—	—	—	—
2.269	281411	M	L	83 400	76 500	14.0	72 600	52 200	134 900	163 400	118 600	132 100	—	—	—	—
			LT	83 700	72 300	12.0	77 200	50 700	133 400	162 600	117 100	132 900	—	—	—	—
		C	L	87 100	79 700	10.0	75 700	48 500	130 400§§	160 000§§	115 000§§	134 600§§	122 300	153 100	108 700	132 100
			LT	86 800	76 400	10.0	78 500	48 500	127 700	160 500	111 600	134 900	117 800	155 900	105 900	133 500
			ST	82 100	68 700	6.0	77 900	—	—	—	—	—	—	—	—	—
2.501	301894	M	L	77 600	71 300	14.0	66 200	48 700	123 000	153 700	111 800	124 300	—	—	—	—
			LT	81 800	70 800	10.5	72 000	48 500	124 400	154 300	109 800	125 700	—	—	—	—
		C	L	85 800	76 200	9.0	73 200	46 100	123 600	155 700	109 400	123 600	114 500	148 300	105 800	119 000
			LT	84 500	73 300	9.0	77 200	44 700	123 300	153 100	108 400	126 400	101 600	142 000	101 600	120 000
			ST	74 500	65 200	3.1	74 100	—	—	—	—	—	—	—	—	—
2.501	301897	M	L	77 100	71 100	12.0	67 300	48 800	122 700	153 400	110 100	123 600	—	—	—	—
			LT	81 100	70 400	10.0	76 200	48 800	123 900	150 900	110 800	127 100	—	—	—	—
		C	L	85 700	76 100	9.0	76 200	46 500	122 200	150 600	107 200	122 600	103 700	138 800	100 000	119 400
			LT	85 100	75 600	9.0	76 400	43 800	122 400	150 600	107 500	124 300	105 400	137 500	101 300	119 300
			ST	73 100	64 600	1.9	74 800	—	—	—	—	—	—	—	—	—
2.773	281491	M	L	78 200	70 600	11.0	67 100	48 600	123 300	151 400	109 900	127 900	—	—	—	—
			LT	78 500	69 700	8.5	72 300	47 800	126 300	157 700	112 100	131 700	—	—	—	—
		C	L	82 800	73 500	9.0	71 000	46 200	121 100	147 400	107 700	123 100	103 700	138 800	††	124 000
			LT	82 800	73 200	7.5	73 700	45 100	122 100	148 600	107 100	127 900	105 000	139 300	101 400	122 100
			ST	74 600	63 500	2.7	71 300	—	—	—	—	—	—	—	—	—
3.025	281420	M	L	77 500	68 700	11.5	64 200	47 200	124 000	150 800	106 600	125 000	—	—	—	—
			LT	77 900	68 100	10.5	71 400	46 600	123 600	151 400	108 000	126 400	—	—	—	—
		C	L	81 500	72 400	9.5	69 600	45 100	120 700	147 200	105 100	122 200	107 900	139 400	101 400	118 600
			LT	81 200	72 000	9.5	72 700	44 200	122 400	148 300	107 200	124 300	110 800	139 000	101 200	119 900
			ST	74 100	65 800	4.5	76 800	44 200	—	—	—	—	—	—	—	—
3.953	281624	M	L	78 500	69 600	12.0	68 600	46 000	112 100	144 300	99 100	121 400	—	—	—	—
			LT	78 400	69 400	8.0	68 000	46 600	110 500	144 000	100 600	121 400	—	—	—	—
		C	L	82 800	69 300	8.0	65 700	—	—	—	—	—	—	—	—	—
			LT	78 700	68 000	8.0	68 700	44 200	110 400	145 100	100 000	120 700	110 300	137 700	95 000	119 300
			L	75 900	64 900	6.0	68 100	43 100	111 300	145 400	99 300	121 400	99 700	135 700	92 900	117 100
			ST	83 700	59 500	2.4	66 200	—	—	—	—	—	—	—	—	—

* C, center of thickness; M, midway between center and surface of plate.
† Offset equals 0.2 per cent.
§ Offset equals 2 per cent of pin diameter.
** L, longitudinal; LT, long transverse; ST, short transverse.
†† Failed before reaching 2 per cent offset.
‡‡ Pre Producer B; all others from Producer A.
§§ Average of two tests; all others, single tests.
*** Specimens and fixtures cleaned ultrasonically in acetone.

TABLE IX

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 7079-T651 PLATE

Sample				TENSILE			COMP.	SHEAR	BEARING***							
									Flatwise				Edgewise			
									Ultimate Stress, psi		Yield Stress,§ psi		Ultimate Stress, psi		Yield Stress,§ psi	
Thickness, in.	Number and Producer	Location*	Direction**	Ultimate Stress, psi	Yield Stress,† psi	Elongation in 2 in. or 4D, %	Yield Stress,† psi	Ultimate Stress, psi	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0
0.252	281406	C	L	80 600	75 200	13.0	71 800	47 900	128 900	164 500	110 900	133 700	—	—	—	—
			LT	81 500	71 900	11.5	76 000	47 700	132 100	166 500	112 500	135 300	—	—	—	—
0.315	281405	C	L	82 600	77 500	12.5	75 700	46 600	130 300	165 300	112 100	135 700	—	—	—	—
			LT	83 600	74 600	11.5	79 300	47 100	132 100	166 700	113 300	135 300	—	—	—	—
0.501	281390	C	L	85 500	78 900	14.0	76 600	51 100	130 600	161 700	114 300	130 900	—	—	—	—
			LT	85 900	75 800	13.0	80 500	50 000	130 200	158 300	114 500	130 100	—	—	—	—
0.625	281503††	C	L	83 200	78 600	10.7	75 100	46 600	127 600	161 600	111 300	134 600	—	—	—	—
			LT	82 200	74 400	10.7	79 000	47 000	129 400	163 400	114 300	132 900	—	—	—	—
0.750	281676	C	L	79 500	73 400	12.0	71 900	45 600	121 700	160 000	107 100	127 900	—	—	—	—
			LT	80 100	71 800	11.0	75 800	45 300	126 600	162 400	109 200	131 500	—	—	—	—
1.008	281399	C	L	80 200	74 100	13.0	76 800	45 500	124 300	154 000	107 100	124 500	117 400	148 400	101 200	122 400
			LT	80 900	71 500	12.0	74 900	44 400	125 400	150 900	106 500	123 600	120 300	152 500	102 200	124 700
1.500	251698	C	L	84 800	78 300	10.0	76 800	46 500	123 300	157 000	107 900	124 300	116 600	152 000	106 400	127 900
			LT	83 400	74 400	11.2	78 500	45 300	124 900	155 800	106 800	127 100	117 800	151 000	104 400	124 500
1.635	281410	M	L	81 100	75 400	13.0	72 000	49 900	123 700	161 000	106 400	129 300	—	—	—	—
			LT	81 800	72 600	11.0	77 700	49 400	130 400	161 700	113 800	134 500	—	—	—	—
		C	L	80 700	74 500	12.0	76 900	46 000	124 300	152 300	106 500	124 300	122 700	145 200	107 100	126 800
			LT	81 200	71 900	11.0	75 900	45 300	130 100	152 600	112 200	127 100	130 600	146 300	113 700	125 000
2.000	281500††	M	L	79 000	73 900	13.0	73 900	46 100	128 900	163 900	114 300	128 600	—	—	—	—
			LT	80 800	73 000	10.0	78 100	47 900	123 000	163 400	115 700	132 100	—	—	—	—
		C	L	82 700	76 700	9.5	76 700	45 800	123 600	153 600	110 600	125 700	116 400	152 300	107 800	127 900
			LT	81 500	74 800	9.5	79 900	47 700	126 700	156 800	111 400	129 300	113 600	149 900	106 300	127 200
			ST	77 100	68 800	4.2	77 600	—	—	—	—	—	—	—	—	—
2.260	301876	M	L	75 900	70 000	13.0	66 500	48 400	124 700	157 400	111 800	124 300	—	—	—	—
			LT	77 800	68 400	12.5	71 900	48 500	126 700	158 200	110 800	123 600	—	—	—	—
		C	L	82 400	75 300	10.5	71 800	43 950	121 800	153 700	107 000	121 400	112 800	143 500	102 000	117 900
			LT	82 400	73 300	10.0	76 800	44 400	121 900	152 000	106 500	122 900	115 600	145 700	103 000	118 200
			ST	78 100	65 500	5.0	74 000	—	—	—	—	—	—	—	—	—
2.500	301877	M	L	77 000	71 400	12.5	71 500	49 100	126 700	156 000	112 500	124 300	—	—	—	—
			LT	80 200	70 600	9.5	74 700	47 300	129 300	161 100	111 500	124 300	—	—	—	—
		C	L	84 300	78 800	10.0	74 000	47 300	125 600	158 800	110 100	126 000	114 800	147 400	107 200	124 300
			LT	81 600	71 700	9.0	77 100	45 100	125 600	157 100	111 100	127 100	109 700	144 600	102 300	120 000
			ST	76 200	65 700	5.6	75 500	—	—	—	—	—	—	—	—	—
3.000	281842††	M	L	74 500	68 000	13.0	67 000	46 800	120 600	151 400	106 [illegible]	122 900	—	—	—	—
			LT	76 300	67 100	9.5	71 000	45 700	121 200	151 700	106 600	123 600	—	—	—	—
		C	L	79 700	72 300	10.5	70 900	45 700	116 700	147 200	101 700	119 400	109 000	141 200	99 600	119 400
			LT	75 200	65 800	9.0	71 400	43 200	115 400	143 800	100 300	119 400	107 100	137 000	98 400	118 400
			ST	72 100	62 700	5.0	70 100	44 700	—	—	—	—	—	—	—	—

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TABLE IX (CONCLUDED)

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 7079-T651 PLATE

Sample				TENSILE			COMP.	SHEAR	BEARING***							
									Flatwise				Edgewise			
						Elongation			Ultimate Stress, psi		Yield Stress,§ psi		Ultimate Stress, psi		Yield Stress,§ psi	
Thickness, in.	Number and Producer	Location*	Direction**	Ultimate Stress, psi	Yield Stress,† psi	in 2 in. or 4D, %	Yield Stress,† psi	Ultimate Stress, psi	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0
3.000	281554	M	L	74 700	63 900	12.5	66 600	49 000	125 600	158 600	111 400	139 300	—	—	—	—
			LT	78 000	68 700	9.5	72 400	48 300	128 000	160 300	112 800	130 000	—	—	—	—
		C	L	81 600	74 200	10.0	70 400	49 700	123 700	153 900	110 000	127 900	104 900	145 700	††	124 300
			LT	79 800	70 000	9.5	74 000	43 800	124 300	153 400	110 000	128 600	112 400	143 100	104 300	125 000
			ST	72 500	63 300	2.4	72 300	45 000	—	—	—	—	—	—	—	—
3.001	281392	M	L	75 800	70 000	14.0	67 600	49 500	125 900	153 400	110 800	135 700	—	—	—	—
			LT	75 300	69 900	11.0	72 700	46 500	127 000	157 400	111 500	137 400	—	—	—	—
		C	L	80 [illegible]	[illegible]	10.0	71 100	48 500	120 600	148 300	105 000	130 700	109 100	139 500	100 600	117 800
			LT	79 [illegible]	[illegible]	10.5	74 600	44 500	123 700	149 100	107 700	125 700	114 300	142 300	100 900	117 900
			ST	76 [illegible]	[illegible]	4.7	73 300	46 800	—	—	—	—	—	—	—	—
3.777	281580	M	L	77 [illegible]	[illegible]	12.5	68 900	48 300	124 900	157 500	111 400	139 300	—	—	—	—
			LT	76 [illegible]	[illegible]	10.5	73 700	46 800	127 000	161 400	112 100	139 000	—	—	—	—
		C	L	81 [illegible]	[illegible]	10.0	71 400	45 100	123 000	157 500	109 900	127 200	115 600	147 000	104 900	125 000
			LT	79 [illegible]	[illegible]	9.5	74 000	43 700	127 700	157 000	109 200	130 000	111 200	145 000	104 200	125 400
			ST	72 400	62 900	2.9	71 900	—	—	—	—	—	—	—	—	—
4.001	281490	M	L	74 [illegible]	[illegible]	11.5	68 200	47 600	124 300	156 500	109 200	135 000	—	—	—	—
			LT	76 [illegible]	[illegible]	11.5	72 900	47 300	125 300	154 300	109 900	135 400	—	—	—	—
		C	L	79 [illegible]	[illegible]	9.0	71 500	44 700	124 000	153 400	108 600	127 100	111 700	145 000	102 600	125 000
			LT	77 [illegible]	[illegible]	9.5	75 000	43 300	120 400	149 000	104 900	122 100	111 400	142 200	99 900	120 700
			ST	71 [illegible]	[illegible]	3.6	74 100	—	—	—	—	—	—	—	—	—
4.499	281392	M	L	74 [illegible]	[illegible]	9.0	64 700	46 600	116 300	143 500	103 000	119 300	—	—	—	—
			LT	74 [illegible]	[illegible]	7.5	68 900	46 600	122 000	143 600	103 600	122 100	—	—	—	—
		C	L	74 [illegible]	[illegible]	6.0	70 600	—	—	—	—	—	—	—	—	—
			LT	74 [illegible]	[illegible]	6.0	67 100	43 000	116 000	143 500	99 900	119 300	111 200	139 500	97 700	117 100
			ST	69 [illegible]	[illegible]	3.0	67 200	43 500	115 500	140 200	101 300	115 700	105 000§§	134 400§§	95 700§§	116 300§§
4.770	301879	M	L	71 [illegible]	64 300	13.0	63 400	46 600	116 500	147 400	104 100	117 500	—	—	—	—
			LT	74 [illegible]	66 900	10.0	68 400	46 600	119 000	150 000	105 500	121 200	—	—	—	—
		C	L	77 [illegible]	[illegible]	9.7	68 600	—	—	—	—	—	—	—	—	—
			LT	75 [illegible]	[illegible]	9.0	68 100	42 800	115 600	145 200	102 300	116 800	101 100	129 000	94 900	111 100
			ST	68 100	59 900	2.6	67 800	42 300	115 600	144 900	100 600	115 100	98 000	132 900	96 200	111 700
							66 600	—	—	—	—	—	—	—	—	—
6.000	301876	M	L	71 000	61 700	11.5	58 000	44 500	112 500	139 200	97 300	113 200	—	—	—	—
			LT	70 000	58 700	6.0	63 100	44 400	111 600	140 300	98 000	115 100	—	—	—	—
		C	L	69 [illegible]	[illegible]	5.1	63 800	—	—	—	—	—	—	—	—	—
			LT	74 [illegible]	[illegible]	9.0	64 200	42 700	111 400	142 900	97 900	113 300	106 000	136 900	95 200	110 100
			ST	68 [illegible]	[illegible]	6.0	63 800	42 400	109 400	136 600	96 200	112 200	102 000	131 800	92 800	110 100
				68 000	56 500	4.5	61 600	—	—	—	—	—	—	—	—	—

* C, center of thickness; M, midway between center and surface of plate.
† Offset equals 0.2 per cent.
‡ Offset equals 2 per cent of pin diameter.
** L, longitudinal; LT, long transverse; ST, short transverse.

†† Failed before reaching 2 per cent offset.
‡‡ From Producer B; all others from Producer A.
§§ Average of two tests; all others, single tests.
*** Specimens and fixtures cleaned ultrasonically in acetone.

TABLE X

MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 7178-T651 PLATE

Sample				TENSILE			COMP.	SHEAR	BEARING***							
									Flatwise				Edgewise			
									Ultimate Stress, psi		Yield Stress,§ psi		Ultimate Stress, psi		Yield Stress,§ psi	
Thickness, in.	Number and Producer	Location*	Direction**	Ultimate Stress, psi	Yield Stress,‡ psi	Elongation in 2 in. or 4D, %	Yield Stress,‡ psi	Ultimate Stress, psi	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0	e/D=1.5	e/D=2.0
0.250	252461	C	L	90 100	84 600	9.5	80 800	53 100	136 200	169 900	120 800	139 800	—	—	—	—
			LT	88 800	79 200	10.5	86 200	52 000	135 800	161 200	119 400	140 400	—	—	—	—
0.252	281415	C	L	87 900	83 000	13.5	80 600	52 400	138 900	173 300	124 500	149 300	—	—	—	—
			LT	88 600	77 900	13.0	87 100	52 000	137 600	176 500	124 100	151 100	—	—	—	—
0.276	301835	C	L	87 100	82 200	12.0	80 600	54 100	137 900	175 000	126 300	152 800	—	—	—	—
			LT	87 300	81 200	12.0	85 100	54 200	137 900	174 100	125 900	153 900	—	—	—	—
0.284	301[illegible]4	C	L	88 900	84 300	13.0	82 700	55 100	139 100	173 200	128 200	151 700	—	—	—	—
			LT	90 100	80 700	11.0	87 600	54 800	140 700	176 800	127 400	153 500	—	—	—	—
0.312	281501††	C	L	88 300	80 800	13.5	80 200	51 100	137 300	170 000	128 200	142 700	—	—	—	—
			LT	87 500	76 300	13.0	83 000	51 400	137 600	172 200	128 400	146 900	—	—	—	—
0.403	281419	C	L	87 600	82 100	12.0	82 900	52 100	136 600	171 100	117 900	140 000	—	—	—	—
			LT	89 400	79 100	11.5	87 800	51 100	137 200	166 800	119 300	139 900	—	—	—	—
0.435	281485	C	L	89 200	84 300	13.0	82 400	51 500	140 200	172 800	125 000	146 700	—	—	—	—
			LT	89 800	80 200	13.0	87 200	50 800	140 800	170 800	123 600	145 100	—	—	—	—
0.435	301733†††	C	L	87 500	80 800	11.0	82 800	51 600	135 100	168 600	118 600	140 000	—	—	—	—
			LT	88 000	77 700	9.5	84 600	51 200	135 700	166 000	120 400	141 [illegible]	—	—	—	—
0.500	251760	C	L	90 300	83 900	10.0	81 800	50 600	134 200	167 [illegible]	117 200	[illegible] 00	—	—	—	—
			LT	89 300	81 000	10.3	84 600	48 800	131 600	155 300	115 200	[illegible] 00	—	—	—	—
0.500	281663††	C	L	88 000	82 500	11.5	81 500	51 700	136 400	167 500	121 400	[illegible] 100	—	—	—	—
			LT	90 600	82 300	11.5	89 000	51 700	136 900	168 300	121 400	[illegible] 300	—	—	—	—
0.504	281416	C	L	90 400	84 200	12.0	80 100	51 200	134 100	164 000	117 [illegible]	[illegible] 900	—	—	—	—
			LT	91 000	81 500	11.0	84 900	50 300	138 100	167 200	118 80[illegible]	140 600	—	—	—	—
0.504	281488	C	L	90 900	83 500	13.0	79 300	50 800	136 200	167 500	121 400	137 200	—	—	—	—
			LT	92 400	80 800	12.0	84 700	50 500	138 900	165 800	123 600	142 100	—	—	—	—
0.520	301734†††	C	L	93 900	89 500	10.0	85 700	53 400	136 300	168 300	121 400	145 300	—	—	—	—
			LT	93 900	85 900	10.0	89 600	52 200	141 500	171 900	126 600	148 400	—	—	—	—
0.750	281734	C	L	90 100	83 000	11.0	80 400§§	49 500	133 100	170 000	117 900	140 000	—	—	—	—
			LT	88 700	73 900	9.5	84 200	48 800	131 300	164 300	116 400	142 100	—	—	—	—
1.000	251777	C	L	89 600	81 000	10.8	81 800	51 200	132 600	167 800	115 800	137 000	115 700	152 800	114 000	136 900
			LT	90 100	80 800	10.8	86 100	49 100	131 800	164 800	115 800	136 300	107 900	145 700	††	134 800
1.000	281657††	C	L	92 100	85 700	9.5	83 300	49 300	132 500	165 100	121 400	141 300	—	—	—	—
			LT	91 600	83 500	9.5	87 300	48 300	134 100	164 800	121 400	141 300	—	—	—	—
1.250	251736	C	L	94 900	85 300	9.0	82 100	49 700	133 100	165 400	121 400	144 300	118 600	154 500	112 600	142 400
			LT	94 900	85 300	9.0	86 800	48 400	133 800	163 600	120 000	145 800	111 400	150 900	††	138 600

* C, center of thickness; M, midway between center and surface of plate.
‡ Offset equals 0.2 per cent.
§ Offset equals 2 per cent of pin diameter.
** L, longitudinal; LT, long transverse.
†† Failed before reaching 2 per cent offset.

†† From Producer B.} All others from Producer A.
††† From Producer C.}
§§ Average of two tests; all others, single tests.
*** Specimens and fixtures cleaned ultrasonically in acetone.

TABLE XI

MECHANICAL PROPERTIES OF PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER
[Contract No. AF33(657)-7837]

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Location**	Direction**	TENSILE Ultimate Stress, psi	TENSILE Yield Stress,‡ psi	TENSILE Elongation in 2 in. or 4D, %	COMP. Yield Stress,‡ psi	SHEAR Ultimate Stress, psi	BEARING*** Flatwise Ultimate Stress, psi e/D=1.5	BEARING*** Flatwise Ultimate Stress, psi e/D=2.0	BEARING*** Flatwise Yield Stress,§ psi e/D=1.5	BEARING*** Flatwise Yield Stress,§ psi e/D=2.0	BEARING*** Edgewise Ultimate Stress, psi e/D=1.5	BEARING*** Edgewise Ultimate Stress, psi e/D=2.0	BEARING*** Edgewise Yield Stress,§ psi e/D=1.5	BEARING*** Edgewise Yield Stress,§ psi e/D=2.0
2014-T6	0.312	281364A	C	L	69 200	62 100	12.0	66 900	46 100	114 200	145 900	103 500	121 600	---	---	---	---
				LT	71 100	62 800	10.0	67 200	42 600	114 200	144 700	102 900	123 600	---	---	---	---
	0.550	281365A	C	L	70 900	63 600	12.5	69 300	44 200	111 900	142 900	96 900	115 800	---	---	---	---
				LT	72 500	65 900	10.0	69 800	43 500	113 300	144 300	100 000	117 900	---	---	---	---
	1.001	281366A	C	L	71 300	65 200	9.0	68 700	41 100	109 200	138 100	95 300	113 300	96 900	126 700	94 500	113 300
				LT	72 800	66 700	8.0	69 700	41 200	110 100	140 400	96 900	115 200	92 800	121 200	††	110 200
	2.500	281547A	A	L	68 600	62 400	9.5	64 300	42 200	111 500	140 800	100 600	118 100	---	---	---	---
				LT	70 900	64 400	7.5	64 900	41 900	111 200	140 500	99 900	118 500	---	---	---	---
			C	L	68 800	62 400	6.5	63 400	38 900	103 500§§	130 700§§	84 100§§	111 600§§	95 700	121 500	90 600	109 800
				LT	68 300	61 800	5.5	63 500	38 400	104 200	131 400	93 200	110 200	91 500	121 500	89 700	108 500
				ST	64 200	60 000	1.5	63 700	—	---	---	---	---	---	---	---	---
2024-T42	0.252	281433A	C	L	70 900	45 300	21.5	47 300	42 800	108 600	136 500	82 700	96 200	---	---	---	---
				LT	69 300	44 000	21.5	46 600	43 200	109 800	133 400	79 900	96 600	---	---	---	---
	0.501	281378A	C	L	69 500	44 600	23.5	46 800	42 500	102 700	124 000	77 700	90 400	---	---	---	---
				LT	69 300	43 800	22.0	46 600	42 100	106 500	128 700	78 600	90 900	---	---	---	---
	1.001	281377A	C	L	67 700	43 800	22.0	45 800	41 100	96 600	125 700	73 400	88 300	93 400	116 900	77 500	94 400
				LT	68 500	43 900	20.0	46 600	41 100	104 800	131 700	77 900	87 800	98 400	125 600	75 000	88 100
	2.001	281372A	M	L	68 500	44 700	19.0	47 000	41 600	103 000	121 600	79 800	89 700	---	---	---	---
				LT	67 900	44 100	17.5	47 200	42 800	104 300	127 600	80 300	93 800	---	---	---	---
			C	L	71 500	47 400	16.0	49 000	38 200	100 700	121 600	77 600	91 200	91 400	122 800	74 600	91 300
				LT	70 600	46 500	15.5	50 000	38 500	100 000	125 700	75 300	90 200	91 700	121 600	74 700	89 600
				ST	66 200	45 000	6.0	46 600	--	---	---	---	---	---	---	---	---
2024-T62	0.252	281433B	C	L	70 700	57 000	13.5	53 700	43 500	116 100	146 000	96 400	116 500	---	---	---	---
				LT	69 700	55 800	12.5	58 400	42 500	115 700	147 800	96 200	116 800	---	---	---	---
	0.501	281378B	C	L	68 900	55 500	13.5	57 400	42 000	107 900	137 600	91 800	109 200	---	---	---	---
				LT	68 400	55 200	11.0	57 400	40 900	109 000	137 600	91 800	108 800	---	---	---	---
	1.001	281377B	C	L	68 600	56 600	12.5	59 300	41 600	109 300	138 800	93 900	110 900	97 600	127 900	89 700	109 700
				LT	68 700	56 700	10.5	59 500	41 400	109 000	138 100	92 500	109 500	94 700	120 000	90 000	107 600
	2.001	281372B	M	L	68 400	56 000	12.0	57 800	40 500	109 900	138 100	93 800	110 500	---	---	---	---
				LT	68 900	56 500	10.5	58 200	42 200	110 500	139 800	93 000	110 100	---	---	---	---
			C	L	67 900	56 900	10.0	57 900	38 900	106 500	133 900	90 400	107 300	92 000	121 600	87 400	104 800
				LT	67 500	56 700	9.0	58 000	38 200	104 600	133 500	90 200	106 700	93 100	119 300	86 200	104 900
				ST	61 900	55 900	3.0	58 400	--	---	---	---	---	---	---	---	---

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TABLE XI(CONTINUED)

MECHANICAL PROPERTIES OF PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Number	Location*	Direction**	TENSILE Ultimate Stress, psi	TENSILE Yield Stress,‡ psi	TENSILE Elongation in 2 in. or 4D, %	COMP. Yield Stress,‡ psi	SHEAR Ultimate Stress, psi	BEARING*** Flatwise Ultimate Stress, psi e/D=1.5	Flatwise Ultimate Stress, psi e/D=2.0	Flatwise Yield Stress,§ psi e/D=1.5	Flatwise Yield Stress,§ psi e/D=2.0	Edgewise Ultimate Stress, psi e/D=1.5	Edgewise Ultimate Stress, psi e/D=2.0	Edgewise Yield Stress,§ psi e/D=1.5	Edgewise Yield Stress,§ psi e/D=2.0
7075-T6	0.375	281381A	C	L	85 300	77 300	16.0	83 400	53 600	137 400	169 000	120 100	136 300	—	—	—	—
				LT	88 000	76 800	13.5	83 500	51 200	138 100	169 500	119 400	138 300	—	—	—	—
	0.379	301875A	C	L	83 700	75 800	15.0	81 900	49 600	132 700	164 200	115 800	130 600	—	—	—	—
				LT	85 000	75 000	13.0	80 700	50 000	135 100	162 900	117 800	132 200	—	—	—	—
	0.625	281382A	C	L	85 500	77 100	13.3	82 300	50 300	131 600	165 600	117 900	134 900	—	—	—	—
				LT	87 600	77 700	12.0	82 600	49 100	136 600	165 600	118 600	136 400	—	—	—	—
	1.500	281386A	C	L	86 600	77 300	11.5	80 300	46 700	125 700	155 500	110 900	127 100	116 300	147 200	110 100	122 900
				LT	86 900	77 900	12.0	80 900	45 800	127 500	155 100	111 700	129 200	110 400	150 600	108 100	125 700
	2.250	281380A	M	L	81 200	71 900	11.0	79 100	50 200	131 200	155 100	117 200	126 400	—	—	—	—
				LT	85 700	75 600	11.0	79 200	51 000	131 200	156 100	117 900	127 800	—	—	—	—
			C	L	85 300	75 900	10.0	77 900	46 900	127 100	157 000	113 100	128 500	117 400	152 500	109 600	127 800
				LT	85 600	76 400	10.0	80 300	46 800	129 100	160 500	113 600	131 400	120 700	152 900	108 600	125 000
				ST	78 900	69 700	3.0	76 800	—	—	—	—	—	—	—	—	—
	2.501	281383A	M	L	80 100	71 400	13.0	75 700	50 200	130 100	159 900	115 800	131 400	—	—	—	—
				LT	84 000	75 400	10.5	76 700	49 400	131 300	164 500	116 600	132 600	—	—	—	—
			C	L	83 800	74 600	10.5	77 400	46 700	125 700	156 100	111 600	126 500	114 800	141 800	106 600	124 500
				LT	82 600	73 700	9.0	77 000	46 200	126 100	157 100	112 300	129 900	114 200	147 200	106 000	122 900
				ST	76 600	68 200	2.5	75 200	—	—	—	—	—	—	—	—	—
	2.522	281418A	M	L	78 800	69 900	13.0	73 400	48 900	127 400	158 800	112 200	127 100	—	—	—	—
				LT	83 500	74 600	11.0	75 100	49 200	136 900	161 100	120 000	130 700	—	—	—	—
			C	L	83 800	73 600	10.5	75 800	45 900	125 900	154 800	110 800	127 100	115 100	143 000	105 100	122 900
				LT	84 600	72 700	8.0	75 600	46 700	130 100	157 400	115 800	129 300	114 800	144 600	103 700	124 300
				ST	79 100	71 400	2.7	77 500	—	—	—	—	—	—	—	—	—
	3.001	281387A	M	L	76 000§§	64 900§§	11.5§§	68 300	46 900	125 000	152 000	108 800	122 900	—	—	—	—
				LT	76 400	64 800	10.5	68 600	46 700	126 400	154 000	110 800	122 200	—	—	—	—
			C	L	80 400§§	69 200§§	8.8§§	71 600	44 100	121 200	147 600	108 000	119 300	106 500	136 100	100 900	117 900
				LT	79 100§§	68 300§§	9.2§§	71 000	43 500	127 600	153 600	110 000	125 700	110 200	136 900	102 000	116 400
				ST	71 800§§	62 500§§	3.0§§	68 800	47 900	—	—	—	—	—	—	—	—
7079-T6	0.252	281422A	C	L	77 900	70 600	14.0	75 600	48 600	129 300	162 200	114 200	134 000	—	—	—	—
				LT	79 000	70 400	12.0	76 100	47 600	130 600	163 900	113 200	134 400	—	—	—	—
	0.501	281389A	C	L	84 200	75 700	12.5	78 400	47 300	123 300	153 200	107 000	122 100	—	—	—	—
				LT	82 300	74 200	13.0	78 200	47 000	127 300	154 000	109 900	124 300	—	—	—	—
	1.001	281383A	C	L	80 200	72 700	13.0	76 100	47 400	126 700	158 900	111 500	121 700	120 200	152 200	106 200	127 000
				LT	81 800	73 600	12.0	76 300	45 000	122 900	153 600	106 500	120 700	121 400	151 600	104 300	122 000
	1.280	301857A	C	L	82 400	72 800	11.0	77 800	44 600	123 000	155 700	108 000	122 900	113 300	153 200	105 400	127 800
				LT	82 700	73 900	11.0	77 800	44 200	127 000	159 400	109 400	125 700	122 200	156 300	104 700	123 400
	1.500	301856A	C	L	81 400	72 000	12.0	75 700	45 000	124 600	155 500	106 900	122 100	115 800	149 400	104 200	121 700
				LT	79 400	70 800	11.5	75 900	42 800	120 200	155 700	102 300	120 700	113 400	148 000	101 600	117 200

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TABLE XI(CONCLUDED)

MECHANICAL PROPERTIES OF PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Location*	Direction**	TENSILE Ultimate Stress, psi	TENSILE Yield Stress,‡ psi	TENSILE Elongation in 2 in. or 4D, %	COMP. Yield Stress,‡ psi	SHEAR Ultimate Stress, psi	BEARING*** Flatwise Ultimate Stress, psi e/D=1.5	BEARING*** Flatwise Ultimate Stress, psi e/D=2.0	BEARING*** Flatwise Yield Stress,‡ psi e/D=1.5	BEARING*** Flatwise Yield Stress,‡ psi e/D=2.0	BEARING*** Edgewise Ultimate Stress, psi e/D=1.5	BEARING*** Edgewise Ultimate Stress, psi e/D=2.0	BEARING*** Edgewise Yield Stress,‡ psi e/D=1.5	BEARING*** Edgewise Yield Stress,‡ psi e/D=2.0
7079-T6	1.625	281391A	M	L	79 600	70 900	13.0	74 500	49 200	136 600	157 300	114 400	127 100	---	---	---	---
				LT	80 500	71 600	11.5	76 300	49 300	137 600	161 400	111 700	127 600	---	---	---	---
			C	L	79 900	71 400	12.0	74 800	46 300	122 600	153 300	105 600	121 400	134 100	147 900	105 900	120 100
				LT	80 800	72 800	11.0	76 300	45 400	134 400	155 100	109 000	124 300	119 300	144 700	104 600	122 300
	2.280	301858A	M	L	75 300	66 200	12.0	72 400	43 300	137 400	148 900	118 400	126 600	---	---	---	---
				LT	76 400	67 600	11.5	73 800	43 200	126 100	147 400	109 800	125 700	---	---	---	---
			C	L	79 900	70 900	10.0	72 700	43 200	121 600	141 600	104 900	120 700	111 400	141 300	100 300	117 600
				LT	79 000	70 500	11.5	73 700	43 200	130 700	152 300	104 000	120 700	110 200	141 000	99 000	114 700
				ST	73 100	64 400	3.8	72 700	--	---	---	---	---	---	---	---	---
	2.500	301859A	M	L	76 300	67 600	13.5	73 800	44 400	137 400	157 100	111 600	126 400	---	---	---	---
				LT	78 700	69 800	9.5	75 000	44 200	136 700	165 300	112 200	130 000	---	---	---	---
			C	L	80 200	70 600	11.0	74 300	45 000	137 000	158 300	107 700	122 400	113 100	142 000	102 700	121 400
				LT	79 300	70 300	9.0	75 000	44 300	124 400	159 200	107 000	124 300	109 000	141 500	102 400	120 300
				ST	74 300	67 500	3.0	72 700	--	---	---	---	---	---	---	---	---
	3.001	281423A	M	L	75 100	66 200	13.5	71 200	48 900	119 900	149 900	105 000	121 400	---	---	---	---
				LT	73 600	69 000	10.0	72 500	47 400	130 300	161 300	109 500	122 200	---	---	---	---
			C	L	80 600	71 600	10.0	73 500	45 600	117 500	146 600	105 100	120 700	107 000	141 000	101 400	118 100
				LT	78 400	69 800	9.0	73 800	45 100	119 400	149 400	104 500	122 900	109 800	139 400	101 700	119 500
				ST	74 500	67 000	3.7	72 200	47 600	---	---	---	---	---	---	---	---
	4.000	301860A	M	L	71 700	62 500	10.5	64 000	47 300	120 600	154 300	109 300	122 900	---	---	---	---
				LT	73 700	64 400	8.5	69 200	46 300	122 400	154 000	108 700	125 400	---	---	---	---
				ST	71 300	65 600	3.6	65 700	--	---	---	---	---	---	---	---	---
			C	L	77 600	69 700	8.0	71 500	43 600	113 100	148 600	104 700	120 300	104 500	141 000	98 700	115 700
				LT	77 200	67 800	7.5	73 200	43 500	121 300	147 400	106 000	122 300	103 700	137 000	98 000	115 100
				ST	68 700	60 800	2.0	68 300	--	---	---	---	---	---	---	---	---
	5.040	301850A	M	L	71 800	62 500	13.0	67 800	46 700	121 300	153 400	105 000	122 400	---	---	---	---
				LT	74 000	63 800	9.0	68 800	46 300	123 600	154 500	108 700	122 400	---	---	---	---
				ST	72 000	66 000	4.0	69 100	--	---	---	---	---	---	---	---	---
			C	L	78 600	68 600	9.5	71 900	43 400	119 600	148 600	103 700	118 900	104 000	138 000	98 700	115 500
				LT	76 700	67 500	7.0	71 600	43 600	119 200	150 300	104 100	119 600	104 500	138 600	98 700	115 100
				ST	69 800	61 900	3.0	68 300	--	---	---	---	---	---	---	---	---
	5.866	301851A	M	L	71 300	61 400	11.0	65 800	45 900	119 700	151 700	106 700	122 900	---	---	---	---
				LT	73 100	62 700	9.0	66 800	45 400	121 000	152 000	107 000	121 400	---	---	---	---
				ST	68 300	63 300	2.3	64 900	--	---	---	---	---	---	---	---	---
			C	L	76 900	66 700	8.5	68 600	42 700	115 900	146 300	102 700	113 900	106 900	134 300	97 600	113 300
				LT	75 500	65 700	6.5	68 600	42 600	114 900	144 600	100 700	115 000	103 400	135 500	95 300	113 900
				ST	65 800	59 500	1.6	65 200	--	---	---	---	---	---	---	---	---
7178-T6	0.250	301880A	C	L	90 000	82 300	13.0	89 200	54 300	141 500	176 800	129 800	152 300	---	---	---	---
				LT	91 000	80 900	12.5	87 700	53 600	142 900	180 600	129 600	154 900	---	---	---	---
	0.252	281421A	C	L	91 500	84 400	15.0	90 400	54 600	143 400	178 800	132 300	156 600	---	---	---	---
				LT	91 700	80 700	14.0	87 100	56 600	145 400	178 400	132 500	154 700	---	---	---	---
	0.633	301898A	C	L	93 200	84 200	11.3	88 800	51 700	134 100	168 200	116 900	136 400	---	---	---	---
				LT	91 500	82 900	10.7	88 300	49 600	135 300	160 500	117 700	137 000	---	---	---	---

* C, center of thickness; M, midway between center and surface of plate.
† All samples received in the -O or -F temper (Table I) from Producer A and heat treated to the "heat-treated-by-user" temper by Alcoa Research Laboratories.
‡ Offset equals 0.2 per cent.
§ Offset equals 2 per cent of pin diameter.
** L, longitudinal; LT, long transverse; ST, short transverse.
†† Failed before reaching 2 per cent offset.
§§ Average of two tests; all others, single tests.
*** Specimens and fixtures cleaned ultrasonically in acetone.

TABLE XII

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF STRESS-RELIEVED STRETCHED 2014-T651 PLATE

Sample			Longitudinal/Long Transverse				In The Same Direction		Short Transverse/Long Transverse		
Thickness, in.	Number and Producer	Location*	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	SU(L)/TUS(LT)	CYS(LT)/TYS(LT)	SU(LT)/TUS(LT)	TUS(ST)/TUS(LT)	TYS(ST)/TYS(LT)	CYS(ST)/TYS(LT)
0.250	252458	C	0.99	1.03	1.01	0.63	1.06	0.63	—	—	—
0.312	281401	C	0.98	1.03	1.00	0.61	1.05	0.61	—	—	—
0.312	3017127	C	1.01	1.05	1.07	0.63	1.10	0.61	—	—	—
0.314	281485	C	0.98	1.02	1.02	0.63	1.07	0.62	—	—	—
0.500	251757	C	1.00	1.03	0.99	0.64	1.04	0.61	—	—	—
0.500	281409	C	0.97	1.03	0.98	0.62	1.03	0.61	—	—	—
0.500	301855	C	0.98	1.03	1.00	0.63	1.05	0.62	—	—	—
0.643	301891	C	0.99	1.01	0.97	0.60	1.04	0.59	—	—	—
0.756	281518	C	0.99	1.02	0.98	0.60	1.04	0.59	—	—	—
1.000	251739	C	0.99	1.02	0.98	0.59	1.03	0.59	—	—	—
1.001	281398	C	1.00	1.02	1.00	0.59	1.03	0.58	—	—	—
1.125	281553	C	0.99	1.02	0.98	0.60	1.04	0.58	—	—	—
1.500	301844	C	1.01	1.02	1.01	0.58	1.03	0.57	—	—	—
1.501	301652	M	1.01	1.06	1.02	0.62	1.05	0.61	—	—	—
		C	1.01	1.03	1.02	0.57	1.04	0.55	—	—	—
1.891	281486	M	1.01	1.04	1.01	0.61	1.06	0.60	—	—	—
		C	0.99	1.00	0.99	0.58	1.02	0.56	—	—	—
2.000	281656**	M	1.01	1.04	0.99	0.61	1.05	0.61	—	—	—
		C	1.05	1.05	1.03	0.58	1.05	0.57	0.96	0.96	1.07
2.001	281580	M	0.98	1.02	0.99	0.62	1.05	0.61	—	—	—
		C	1.01	1.02	1.01	0.58	1.04	0.56	0.94	0.96	1.05
2.250	281655**	M	1.01	1.02	0.99	0.62	1.05	0.60	—	—	—
		C	1.06	1.07	1.04	0.59	1.06	0.57	0.95	0.96	1.06
2.500	281597	M	1.00	1.04	0.98	0.60	1.03	0.60	—	—	—
		C	1.01	1.03	1.00	0.55	1.05	0.54	0.93	0.95	1.05

* C, center of thickness; M, midway between center and surface of plate.
† From Producer C. All others from Producer A.
** From Producer B.

TABLE XIII

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T351 PLATE

Sample			Longitudinal/Long Transverse				In The Same Direction		Short Transverse/Long Transverse		
Thickness, in.	Number and Producer	Location*	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	SU(L)/TUS(LT)	CYS(LT)/TYS(LT)	SU(LT)/TUS(LT)	TUS(ST)/TUS(LT)	TYS(ST)/TYS(LT)	CYS(ST)/TYS(LT)
0.250	252464	C	1.02	1.19	0.95	0.63	1.11	0.62	—	—	—
0.250	281506**	C	1.01	1.17	0.97	0.63	1.10	0.61	—	—	—
0.250	301837	C	1.02	1.16	0.93	0.62	1.09	0.62	—	—	—
0.308	301838	C	1.01	1.16	0.96	0.63	1.08	0.62	—	—	—
0.312	281374	C	1.03	1.20	0.99	0.64	1.11	0.62	—	—	—
0.373	301839	C	1.01	1.14	0.96	0.63	1.07	0.62	—	—	—
0.375	281375	C	1.03	1.22	1.02	0.61	1.17	0.62	—	—	—
0.440	281601**	C	1.01	1.09	0.98	0.60	1.06	0.59	—	—	—
0.500	251758	C	1.02	1.16	0.93	0.64	1.05	0.64	—	—	—
0.501	281370	C	1.00	1.16	0.97	0.63	1.07	0.62	—	—	—
0.505	281659**	C	1.00	1.15	0.93	0.60	1.07	0.60	—	—	—
0.567	281489	C	0.99	1.13	0.90	0.58	1.03	0.58	—	—	—
0.720	281403	C	0.95	1.11	0.91	0.60	1.07	0.60	—	—	—
0.750	281369	C	1.00	1.20	0.91	0.62	1.08	0.61	—	—	—
0.805	281664**	C	0.99	1.14	0.91	0.58	1.06	0.57	—	—	—
1.000	281508**	C	1.07	1.18	0.96	0.57	1.10	0.56	—	—	—
1.001	281379	C	1.02	1.14	0.95	0.57	1.11	0.56	—	—	—
1.009	281487	C	1.00	1.10	0.90	0.56	1.04	0.56	—	—	—
1.015	281510**	C	1.03	1.16	0.96	0.57	1.08	0.55	—	—	—
1.250	281373	C	1.01	1.12	0.92	0.58	1.05	0.56	—	—	—
1.500	251697	C	1.01	1.12	0.93	0.60	1.05	0.59	—	—	—
1.980	301845	M	1.02	1.14	0.92	0.63	1.08	0.62	—	—	—
		C	1.01	1.11	0.94	0.56	1.05	0.55	0.88	0.90	1.06
2.000	301819	M	1.02	1.14	0.92	0.63	1.06	0.62	—	—	—
		C	1.01	1.10	0.92	0.55	1.04	0.55	0.85	0.89	1.05
2.000	281844**	M	1.05	1.13	0.94	0.66	1.05	0.62	—	—	—
		C	1.07	1.14	0.98	0.57	1.07	0.56	0.84	0.90	1.07
2.001	281581	M	1.03	1.15	0.91	0.63	1.05	0.62	—	—	—
		C	1.04	1.13	0.93	0.59	1.06	0.56	0.84	0.91	1.05
2.250	281598	M	1.01	1.16	0.96	0.62	1.08	0.60	—	—	—
		C	1.06	1.17	0.97	0.59	1.08	0.55	0.92	0.96	1.07
2.250	301782	M	1.01	1.12	0.91	0.62	1.06	0.61	—	—	—
		C	1.03	1.13	0.94	0.53	1.03	0.52	0.84	0.87	1.02
2.515	281749	M	1.01	1.10	0.91	0.61	1.06	0.59	—	—	—
		C	1.05	1.11	0.95	0.55	1.02	0.55	0.85	0.86	1.03
2.800	301848	M	0.99	1.09	0.91	0.62	1.05	0.62	—	—	—
		C	1.05	1.16	1.01	0.57	1.09	0.56	0.89	0.88	1.07
3.000	301846	M	1.05	1.17	0.92	0.63	1.07	0.64	—	—	—
		C	1.01	1.11	0.95	0.55	1.05	0.55	0.86	0.93	1.06

* C, center of thickness; M, midway between center and surface of plate.
** From Producer B; all others from Producer A.

TABLE XIV

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T851 PLATE

Sample			Longitudinal/Long Transverse				In The Same Direction		Short Transverse/Long Transverse		
Thickness, in.	Number and Producer	Location*	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	SU(L)/TUS(LT)	CYS(LT)/TYS(LT)	SU(LT)/TUS(LT)	TUS(ST)/TUS(LT)	TYS(ST)/TYS(LT)	CYS(ST)/TYS(LT)
0.250	252464A	C	1.01	1.01	1.00	0.57	1.02	0.57	—	—	—
0.312	281400	C	1.01	1.02	1.01	0.59	1.02	0.58	—	—	—
0.375	281371	C	1.00	1.00	1.00	0.57	1.03	0.57	—	—	—
0.440	281660**	C	1.00	1.01	1.04	0.54	1.04	0.54	—	—	—
0.499	301853	C	1.00	1.01	1.00	0.58	1.01	0.58	—	—	—
0.500	281758A	C	1.01	1.02	1.03	0.60	1.05	0.60	—	—	—
0.500	281662**	C	1.01	1.05	1.03	0.60	1.05	0.59	—	—	—
0.501	281368	C	1.00	1.01	1.00	0.59	1.01	0.59	—	—	—
0.567	281490	C	1.01	1.03	1.02	0.57	1.02	0.57	—	—	—
0.720	281402	C	0.98	1.00	0.99	0.58	1.00	0.58	—	—	—
0.750	281367	C	1.00	1.02	1.00	0.58	1.00	0.58	—	—	—
0.805	281658**	C	1.00	1.02	0.99	0.57	1.01	0.57	—	—	—
1.001	281376	C	1.02	1.02	1.02	0.57	1.00	0.56	—	—	—
1.009	281511	C	1.01	1.01	1.02	0.56	1.02	0.56	—	—	—
1.250	281412	C	1.01	1.01	1.01	0.57	1.01	0.57	—	—	—
1.500	251697A	C	1.01	1.02	0.99	0.58	1.02	0.58	—	—	—
2.001	281590	M	1.01	1.01	0.98	0.58	1.01	0.59	—	—	—
		C	1.00	1.00	1.00	0.56	1.01	0.56	0.94	0.98	1.03
2.250	281615	M	1.00	1.03	0.98	0.58	1.01	0.57	—	—	—
		C	1.01	1.00	1.00	0.56	1.00	0.55	0.97	0.99	1.04
2.250	301783	M	0.99	0.99	0.96	0.57	0.99	0.58	—	—	—
		C	0.99	0.97	1.00	0.55	1.00	0.56	0.94	0.97	1.02
2.515	281750	M	1.00	1.01	0.96	0.59	1.01	0.57	—	—	—
		C	0.99	0.98	1.00	0.56	1.00	0.55	0.94	0.97	1.04

* C, center of thickness; M, midway between center and surface of plate.
** From Producer B; all others from Producer A.

TABLE XV

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF STRESS-RELIEVED STRETCHED 7075-T651 PLATE

Sample: Thickness, in.	Sample: Number and Producer	Sample: Location*	Longitudinal/Long Transverse: TUS(L)/TUS(LT)	Longitudinal/Long Transverse: TYS(L)/TYS(LT)	Longitudinal/Long Transverse: CYS(L)/TYS(LT)	Longitudinal/Long Transverse: SU(L)/TUS(LT)	In The Same Direction: CYS(LT)/TYS(LT)	In The Same Direction: SU(LT)/TUS(LT)	Short Transverse/Long Transverse: TUS(ST)/TUS(LT)	Short Transverse/Long Transverse: TYS(ST)/TYS(LT)	Short Transverse/Long Transverse: CYS(ST)/TYS(LT)
0.314	281404	C	0.99	1.06	1.01	0.59	1.06	0.58	—	—	—
0.375	281505**	C	1.01	1.05	1.03	0.56	1.10	0.55	—	—	—
0.378	301874	C	0.98	1.02	1.02	0.62	1.08	0.61	—	—	—
0.420	281636	C	0.99	1.03	1.00	0.60	1.06	0.57	—	—	—
0.434	281595	C	0.99	1.06	1.03	0.59	1.08	0.58	—	—	—
0.500	270087	C	1.01	1.04	0.97	0.56	1.03	0.53	—	—	—
0.501	281504**	C	1.01	1.04	1.01	0.58	1.07	0.56	—	—	—
0.504	281414	C	1.00	1.04	1.00	0.57	1.05	0.55	—	—	—
0.505	281413	C	0.99	1.04	1.00	0.57	1.06	0.56	—	—	—
0.875	281509**	C	1.01	1.05	1.03	0.57	1.07	0.55	—	—	—
0.882	281484	C	1.02	1.04	1.01	0.57	1.06	0.54	—	—	—
1.125	281507**	C	1.00	1.05	1.00	0.58	1.08	0.58	—	—	—
1.250	281661	C	1.03	1.04	1.02	0.55	1.05	0.54	—	—	—
1.250	281394	C	1.02	1.06	1.02	0.56	1.07	0.55	—	—	—
1.625	281385	M	1.00	1.05	1.00	0.62	1.07	0.61	—	—	—
		C	1.01	1.03	0.99	0.59	1.05	0.53	—	—	—
2.001	281502**	M	1.00	1.04	1.03	0.60	1.07	0.58	—	—	—
		C	1.04	1.07	1.05	0.58	1.07	0.56	0.95	0.95	1.06
2.250	281417	M	0.96	1.00	0.98	0.60	1.05	0.60	—	—	—
		C	1.04	1.07	1.04	0.57	1.08	0.56	0.95	0.93	1.07
2.250	281654**	M	1.01	1.05	0.98	0.61	1.08	0.61	—	—	—
		C	0.98	1.02	0.98	0.55	1.03	0.54	0.89	0.87	1.03
2.269	281411	M	1.00	1.06	1.00	0.63	1.07	0.61	—	—	—
		C	1.00	1.04	0.99	0.56	1.03	0.56	0.95	0.90	1.02
2.501	301894	M	0.95	1.01	0.93	0.60	1.02	0.60	—	—	—
		C	1.02	1.04	1.00	0.55	1.06	0.53	0.88	0.89	1.02
2.501	301897	M	0.96	1.01	0.96	0.60	1.08	0.60	—	—	—
		C	1.02	1.04	1.05	0.54	1.06	0.53	0.88	0.89	1.03
2.773	281491	M	1.02	1.07	1.02	0.62	1.10	0.61	—	—	—
		C	1.06	1.10	1.06	0.58	1.10	0.57	0.94	0.95	1.06
3.025	281420	M	1.00	1.04	0.97	0.61	1.08	0.62	—	—	—
		C	1.02	1.05	1.01	0.56	1.05	0.55	0.92	0.90	1.02
3.953	281684	M	0.97	1.00	0.94	0.60	1.06	0.61	0.90	0.94	1.02
		C	1.03	1.06	1.01	0.58	1.06	0.57	0.91	0.92	1.02

* C, center of thickness; M, midway between center and surface of plate.
** From Producer B; all others from Producer A.

TABLE XVI

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF STRESS-RELIEVED STRETCHED 7079-T651 PLATE

Sample: Thickness, in.	Sample: Number and Producer	Location*	Longitudinal/Long Transverse: TUS(L)/TUS(LT)	Longitudinal/Long Transverse: TYS(L)/TYS(LT)	Longitudinal/Long Transverse: CYS(L)/TYS(LT)	Longitudinal/Long Transverse: SU(L)/TUS(LT)	In The Same Direction: CYS(LT)/TYS(LT)	In The Same Direction: SU(LT)/TUS(LT)	Short Transverse/Long Transverse: TUS(ST)/TUS(LT)	Short Transverse/Long Transverse: TYS(ST)/TYS(LT)	Short Transverse/Long Transverse: CYS(ST)/TYS(LT)
0.252	281406	C	0.99	1.05	1.00	0.59	1.06	0.59	—	—	—
0.315	281405	C	1.00	1.04	1.01	0.59	1.06	0.57	—	—	—
0.501	281390	C	1.00	1.04	1.01	0.59	1.06	0.58	—	—	—
0.625	281503**	C	1.01	1.03	1.01	0.57	1.06	0.57	—	—	—
0.750	281676	C	0.99	1.02	1.00	0.57	1.06	0.57	—	—	—
1.008	281393	C	0.99	1.04	0.99	0.56	1.05	0.55	—	—	—
1.500	251698	C	1.02	1.05	1.03	0.56	1.06	0.54	—	—	—
1.635	281410	M	0.99	1.04	0.99	0.61	1.07	0.60	—	—	—
		C	0.99	1.04	0.99	0.57	1.06	0.56	—	—	—
2.000	281500**	M	0.98	1.01	1.01	0.61	1.07	0.59	—	—	—
		C	1.01	1.04	1.04	0.56	1.07	0.55	0.95	0.93	1.03
2.260	301876	M	0.98	1.02	0.97	0.62	1.05	0.62	—	—	—
		C	1.00	1.03	0.98	0.53	1.05	0.54	0.95	0.89	1.01
2.500	301877	M	0.96	1.01	1.01	0.61	1.06	0.59	—	—	—
		C	1.03	1.10	1.03	0.58	1.08	0.55	0.94	0.92	1.05
3.000	281842**	M	0.98	1.01	1.00	0.61	1.06	0.60	—	—	—
		C	1.06	1.10	1.08	0.58	1.09	0.57	0.96	0.95	1.07
3.000	281554	M	0.96	1.00	0.97	0.63	1.05	0.62	—	—	—
		C	1.02	1.06	1.01	0.64	1.06	0.55	0.91	0.90	1.03
3.001	281392	M	1.03	1.01	0.98	0.67	1.05	0.66	—	—	—
		C	1.01	1.04	1.02	0.61	1.07	0.56	0.95	0.93	1.05
3.277	281582	M	0.97	1.01	0.98	0.62	1.06	0.62	—	—	—
		C	1.03	1.06	1.02	0.57	1.06	0.55	0.91	0.90	1.03
4.001	281492	M	0.97	1.03	0.98	0.62	1.06	0.62	0.97	0.96	1.06
		C	1.02	1.06	1.03	0.56	1.04	0.54	0.92	0.90	1.02
4.499	281393	M	0.98	1.01	1.00	0.62	1.06	0.63	1.00	1.00	1.08
		C	1.02	1.06	1.06	0.59	1.06	0.60	0.95	0.95	1.06
4.770	301879	M	0.97	1.01	0.98	0.63	1.04	0.63	0.93	0.99	1.05
		C	1.02	1.06	1.02	0.57	1.04	0.56	0.90	0.92	1.03
6.000	301878	M	1.01	1.05	0.99	0.64	1.06	0.63	0.98	0.99	1.07
		C	1.09	1.13	1.07	0.62	1.08	0.62	0.99	0.98	1.07

* C, center of thickness; M, midway between center and surface of plate.
** Producer B; all others from Producer A.

TABLE XVII

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF STRESS-RELIEVED OVERAGED 7178-T651 PLATE

Sample			Longitudinal/Long Transverse				In The Same Direction		Short Transverse/ Long Transverse		
Thickness, in.	Number and Producer	Location*	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/CYS(LT)	SU(L)/TUS(LT)	CYS(LT)/TYS(LT)	SU(LT)/TUS(LT)	TUS(ST)/TUS(LT)	TYS(ST)/TYS(LT)	CYS(ST)/TYS(LT)
0.250	252461	C	1.01	1.07	1.02	0.60	1.09	0.59	—	—	—
0.252	281415	C	0.98	1.07	1.03	0.59	1.12	0.59	—	—	—
0.276	301835	C	1.00	1.01	0.99	0.62	1.05	0.62	—	—	—
0.284	301861	C	0.99	1.04	1.02	0.61	1.09	0.61	—	—	—
0.312	281501**	C	0.99	1.06	1.05	0.58	1.09	0.59	—	—	—
0.403	281419	C	0.98	1.04	1.05	0.58	1.11	0.57	—	—	—
0.425	281483	C	0.99	1.05	1.03	0.57	1.09	0.57	—	—	—
0.455	301735†	C	0.99	1.04	1.06	0.59	1.09	0.58	—	—	—
0.500	251780	C	1.01	1.04	1.01	0.57	1.04	0.55	—	—	—
0.500	281663**	C	0.97	1.00	0.99	0.57	1.08	0.57	—	—	—
0.504	281416	C	0.99	1.03	0.98	0.56	1.04	0.55	—	—	—
0.504	281488	C	0.98	1.03	0.98	0.55	1.05	0.55	—	—	—
0.520	301734†	C	1.01	1.04	1.00	0.57	1.04	0.56	—	—	—
0.750	281734	C	1.02	1.04	1.01	0.56	1.05	0.55	—	—	—
1.000	251777	C	0.99	1.00	1.01	0.57	1.07	0.54	—	—	—
1.000	281657**	C	1.01	1.03	1.00	0.54	1.05	0.53	—	—	—
1.250	251736	C	1.00	1.02	0.99	0.52	1.04	0.51	—	—	—

* C, center of thickness; M, midway between center and surface of plate.
** From Producer B.
† From Producer C.
All others from Producer A.

TABLE XVIII

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Location*	Longitudinal/Long Transverse TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	SU(L)/TUS(LT)	In The Same Direction CYS(LT)/TYS(LT)	SU(LT)/TUS(LT)	Short Transverse/Long Transverse TUS(ST)/TUS(LT)	TYS(ST)/TYS(LT)	CYS(ST)/TYS(LT)
2014-T6	0.312	281364A	C	0.97	1.00	1.07	0.65	1.07	0.60	—	—	—
	0.550	281365A	C	0.98	0.99	1.05	0.61	1.06	0.60	—	—	—
	1.001	281366A	C	0.98	0.98	1.03	0.56	1.04	0.57	—	—	—
	2.500	281547A	M	0.97	0.97	1.00	0.60	1.01	0.59	—	—	—
			C	1.02	1.02	1.03	0.57	1.03	0.56	0.94	0.97	1.03
2024-T42	0.252	281433A	C	1.02	1.03	1.08	0.62	1.06	0.62	—	—	—
	0.501	281378A	C	1.00	1.02	1.07	0.61	1.06	0.61	—	—	—
	1.001	281377A	C	0.99	1.00	1.04	0.60	1.06	0.60	—	—	—
	2.001	281372A	M	1.01	1.01	1.07	0.61	1.07	0.65	—	—	—
			C	1.01	1.00	1.01	0.54	1.03	0.55	0.85	0.93	0.96
2024-T62	0.252	281433B	C	1.01	1.02	1.05	0.62	1.05	0.61	—	—	—
	0.501	281378B	C	1.01	1.01	1.04	0.61	1.04	0.60	—	—	—
	1.001	281377B	C	1.00	1.00	1.05	0.61	1.05	0.60	—	—	—
	2.001	281372B	M	0.99	0.99	1.02	0.59	1.03	0.61	—	—	—
			C	1.01	1.00	1.02	0.57	1.02	0.56	0.92	0.99	1.03
7075-T6	0.375	281381A	C	0.97	1.01	1.09	0.61	1.09	0.58	—	—	—
	0.379	301875A	C	0.98	1.01	1.09	0.58	1.08	0.59	—	—	—
	0.625	281382A	C	0.98	0.99	1.06	0.57	1.06	0.56	—	—	—
	1.500	281386A	C	1.00	0.99	1.03	0.54	1.04	0.53	—	—	—
	2.250	281380A	M	0.95	0.94	1.03	0.59	1.03	0.60	—	—	—
			C	1.00	0.99	1.02	0.55	1.05	0.55	0.92	0.91	1.02
	2.501	281383A	M	0.95	0.95	1.00	0.60	1.02	0.59	—	—	—
			C	1.01	1.01	1.05	0.57	1.04	0.56	0.93	0.93	1.02
	2.522	281418A	M	0.94	0.94	0.98	0.59	1.01	0.59	—	—	—
			C	0.99	1.01	1.04	0.54	1.04	0.55	0.93	0.98	1.07
	3.001	281387A	M	1.00	1.00	1.05	0.61	1.06	0.61	—	—	—
			C	1.02	1.01	1.05	0.56	1.04	0.55	0.91	0.92	1.01

—CONCLUDED ON NEXT PAGE—

TABLE XVIII (CONCLUDED)

RATIOS AMONG THE TENSILE, COMPRESSIVE AND SHEAR PROPERTIES OF PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Location*	Longitudinal/Long Transverse TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	SU(L)/TUS(LT)	In The Same Direction CYS(LT)/TYS(LT)	SU(LT)/TUS(LT)	Short Transverse/Long Transverse TUS(ST)/TUS(LT)	TYS(ST)/TYS(LT)	CYS(ST)/TYS(LT)
7079-T6	0.252	281422A	C	0.99	1.00	1.07	0.62	1.08	0.62	—	—	—
	0.501	281389A	C	1.02	1.02	1.06	0.57	1.05	0.57	—	—	—
	1.001	281388A	C	0.98	0.99	1.03	0.58	1.04	0.55	—	—	—
	1.280	301857A	C	1.00	0.99	1.05	0.54	1.05	0.53	—	—	—
	1.500	301856A	C	1.03	1.02	1.07	0.57	1.07	0.54	—	—	—
	1.625	281391A	M	0.99	0.99	1.04	0.61	1.07	0.61	—	—	—
			C	0.99	0.98	1.03	0.57	1.05	0.56	—	—	—
	2.280	301858A	M	0.99	0.98	1.07	0.63	1.08	0.63	—	—	—
			C	1.01	1.01	1.05	0.53	1.05	0.53	0.93	0.91	1.03
	2.500	301859A	M	0.97	0.97	1.06	0.61	1.07	0.61	—	—	—
			C	1.01	1.00	1.06	0.57	1.07	0.56	0.94	0.96	1.03
	3.001	281423A	M	0.96	0.96	1.03	0.62	1.07	0.60	—	—	—
			C	1.03	1.03	1.05	0.58	1.06	0.58	0.95	0.96	1.03
	4.000	301860A	M	0.97	0.97	0.99	0.64	1.07	0.63	0.97	1.02	1.02
			C	1.01	1.03	1.05	0.56	1.06	0.56	0.89	0.90	1.00
	4.040	301850A	M	0.97	0.98	1.06	0.63	1.08	0.63	0.97	1.03	1.08
			C	1.02	1.02	1.07	0.57	1.06	0.56	0.91	0.92	1.01
	4.000	301851A	M	0.98	0.98	1.04	0.63	1.07	0.62	0.93	1.01	1.03
			C	1.02	1.02	1.04	0.57	1.04	0.56	0.87	0.91	0.99
7178-T6	0.250	301880A	C	0.99	1.02	1.10	0.60	1.08	0.59	—	—	—
	0.252	281421A	C	1.00	1.05	1.12	0.60	1.08	0.62	—	—	—
	[illegible]	301896A	C	1.02	1.02	1.07	0.56	1.07	0.54	—	—	—

* C, center of thickness; M, midway between center and surface of plate.
† All samples received in the -O or -F temper from Producer A and heat treated to the "heat-treated-by-user" temper by Alcoa Research Laboratories.

TABLE XIX

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF STRESS-RELIEVED STRETCHED 2014-T651 PLATE

Sample			Flatwise								Edgewise							
			BUS(L)/TUS(LT)		BYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		BYS(LT)/TYS(LT)		BUS(L)/TUS(LT)		BYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		BYS(LT)/TYS(LT)	
Thickness, in.	Number and Producer	Location*	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0
0.250	252458	C	1.58	2.00	1.52	1.74	1.58	2.01	1.48	1.77	—	—	—	—	—	—	—	—
0.312	281401	C	1.57	2.04	1.51	1.91	1.56	2.04	1.52	1.92	—	—	—	—	—	—	—	—
0.312	3017125	C	1.63	2.03	1.60	1.89	1.64	2.05	1.62	1.92	—	—	—	—	—	—	—	—
0.314	281485	C	1.63	2.07	1.60	1.82	1.63	2.08	1.61	1.88	—	—	—	—	—	—	—	—
0.500	251757	C	1.58	2.04	1.46	1.76	1.60	2.04	1.53	1.81	—	—	—	—	—	—	—	—
0.500	281409	C	1.56	1.97	1.51	1.76	1.58	2.01	1.54	1.81	—	—	—	—	—	—	—	—
0.500	301855	C	1.61	2.03	1.57	1.85	1.60	2.02	1.58	1.88	—	—	—	—	—	—	—	—
0.642	301891	C	1.56	2.00	1.52	1.71	1.57	2.01	1.51	1.77	—	—	—	—	—	—	—	—
0.756	281518	C	1.58	1.99	1.55	1.87	1.57	1.98	1.57	1.84	—	—	—	—	—	—	—	—
1.000	251739	C	1.54	1.99	1.45	1.79	1.51	1.99	1.46	1.79	1.40	1.79	1.45	1.64	1.43	1.78	1.46	1.69
1.001	281398	C	1.55	1.97	1.47	1.75	1.54	1.96	1.50	1.74	1.42	1.82	1.47	1.80	1.38	1.85	1.46	1.77
1.125	281553	C	1.60	2.02	1.57	1.84	1.61	2.03	1.59	1.85	1.44	1.89	1.48	1.81	1.53	1.90	1.52	1.79
1.500	301844	C	1.53	1.93	1.50	1.74	1.53	1.95	1.49	1.79	1.40	1.82	1.47	1.78	1.40	1.81	1.45	1.76
1.501	301652	M	1.64	2.07	1.61	1.89	1.63	2.03	1.61	1.84	—	—	—	—	—	—	—	—
		C	1.54	1.97	1.50	1.78	1.56	1.93	1.53	1.76	1.33	1.81	†	1.82	1.37	1.82	†	1.82
1.891	281486	M	1.63	2.08	1.62	1.91	1.59	2.04	1.58	1.90	—	—	—	—	—	—	—	—
		C	1.57	2.01	1.57	1.85	1.57	1.92	1.56	1.84	1.41	1.83	1.51	1.82	1.41	1.85	1.50	1.85
2.000	281656**	M	1.60	2.04	1.60	1.80	1.62	2.08	1.61	1.87	—	—	—	—	—	—	—	—
		C	1.57	2.00	1.55	1.76	1.59	2.01	1.57	1.84	1.42	1.88	1.52	1.79	1.35	1.76	†	1.77
2.001	281580	M	1.58	2.01	1.55	1.85	1.60	2.02	1.56	1.85	—	—	—	—	—	—	—	—
		C	1.55	1.97	1.51	1.78	1.55	1.98	1.51	1.81	—	—	—	—	—	—	—	—
2.250	281655**	M	1.58	2.04	1.55	1.80	1.61	2.06	1.59	1.87	—	—	—	—	—	—	—	—
		C	1.54	2.01	1.53	1.84	1.56	1.99	1.50	1.82	—	—	—	—	—	—	—	—
2.500	281597	M	1.62	2.05	1.59	1.88	1.60	2.04	1.56	1.87	—	—	—	—	—	—	—	—
		C	1.53	1.94	1.51	1.78	1.54	1.94	1.52	1.80	1.33	1.73	1.43	1.75	1.28	1.69	†	1.75

* C, center of thickness; M, midway between center and surface of plate.
† Bearing specimen failed before reaching yield stress (2 per cent offset).
** From Producer B.
§ From Producer C.
All others from Producer A.

TABLE XX

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T351 PLATE

Sample			Flatwise								Edgewise							
			BUS(L)/TUS(LT)		BYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		BYS(LT)/TYS(LT)		BUS(L)/TUS(LT)		BYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		BYS(LT)/TYS(LT)	
Thickness, in.	Number and Producer	Location*	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0
0.250	252464	C	1.59	1.98	1.71	2.14	1.63	1.99	1.78	2.23	—	—	—	—	—	—	—	—
0.250	281506**	C	1.58	1.94	1.81	2.18	1.61	1.99	1.83	2.25	—	—	—	—	—	—	—	—
0.250	301837	C	1.56	1.95	1.82	2.17	1.54	1.91	1.85	2.21	—	—	—	—	—	—	—	—
0.308	301838	C	1.54	1.87	1.85	2.21	1.53	1.91	1.89	2.28	—	—	—	—	—	—	—	—
0.312	281374	C	1.59	1.95	1.81	2.15	1.62	1.99	1.83	2.19	—	—	—	—	—	—	—	—
0.373	301839	C	1.54	1.87	1.78	2.10	1.55	1.91	1.76	2.17	—	—	—	—	—	—	—	—
0.375	281375	C	1.59	1.88	1.90	2.24	1.62	1.91	1.90	2.26	—	—	—	—	—	—	—	—
0.440	281661**	C	1.57	1.93	1.75	2.04	1.55	1.94	1.72	2.05	—	—	—	—	—	—	—	—
0.500	251758	C	1.54	1.89	1.74	2.06	1.57	1.92	1.71	2.03	—	—	—	—	—	—	—	—
0.501	281370	C	1.53	1.86	1.78	2.12	1.55	1.94	1.80	2.16	—	—	—	—	—	—	—	—
0.505	281659**	C	1.50	1.89	1.76	2.07	1.51	1.88	1.72	2.06	—	—	—	—	—	—	—	—
0.567	281489	C	1.52	1.88	1.71	2.08	1.54	1.96	1.74	2.08	—	—	—	—	—	—	—	—
0.720	281403	C	1.54	1.89	1.74	2.07	1.59	1.96	1.79	2.16	—	—	—	—	—	—	—	—
0.750	281369	C	1.53	1.88	1.83	2.10	1.56	1.90	1.81	2.16	—	—	—	—	—	—	—	—
0.835	281664**	C	1.47	1.80	1.66	1.94	1.51	1.87	1.70	1.98	—	—	—	—	—	—	—	—
1.000	281508**	C	1.54	1.86	1.66	1.95	1.52	1.87	1.65	1.98	—	—	—	—	—	—	—	—
1.001	281379	C	1.49	1.75	1.64	2.00	1.49	1.81	1.60	1.99	—	—	—	—	—	—	—	—
1.009	281487	C	1.41	1.77	1.61	1.89	1.55	1.91	1.67	2.04	1.35	1.70	1.62	1.97	1.45	1.82	1.60	1.93
1.015	281510**	C	1.47	1.83	1.62	1.95	1.51	1.85	1.61	1.99	1.32	1.85	1.66	1.98	1.36	1.77	1.61	1.91
1.250	281373	C	1.49	1.81	1.64	1.93	1.54	1.84	1.67	2.01	1.40	1.79	1.68	2.00	1.32	1.74	1.60	2.00
1.500	251697	C	1.48	1.89	1.71	2.05	1.52	1.91	1.71	2.04	1.23	1.75	1.67	1.93	1.34	1.72	1.67	1.95
1.980	301845	M	1.55	1.91	1.78	2.14	1.58	1.93	1.78	2.20	—	—	—	—	—	—	—	—
		C	1.44	1.78	1.61	1.95	1.47	1.78	1.60	1.95	1.25	1.65	1.58	1.92	1.31	1.69	1.64	2.01
2.000	301819	M	1.49	1.83	1.72	2.03	1.55	1.88	1.76	2.13	—	—	—	—	—	—	—	—
		C	1.40	1.76	1.58	1.93	1.47	1.81	1.56	1.98	1.25	1.68	1.55	1.89	1.28	1.63	1.52	1.89
2.000	281844**	M	1.57	1.93	1.77	2.11	1.56	1.89	1.78	2.14	—	—	—	—	—	—	—	—
		C	1.46	1.81	1.66	2.00	1.49	1.82	1.68	2.03	1.26	1.67	1.61	2.02	1.28	1.65	1.60	1.93
2.001	281581	M	1.53	1.85	1.82	2.19	1.59	1.93	1.86	2.23	—	—	—	—	—	—	—	—
		C	1.51	1.86	1.72	2.07	1.52	1.86	1.70	2.03	—	—	—	—	—	—	—	—
2.250	281598	M	1.58	1.83	1.84	2.21	1.59	1.93	1.86	2.22	—	—	—	—	—	—	—	—
		C	1.54	1.86	1.81	2.15	1.51	1.87	1.68	2.08	—	—	—	—	—	—	—	—
2.250	301782	M	1.56	1.87	1.73	2.12	1.59	1.89	1.77	2.13	—	—	—	—	—	—	—	—
		C	1.42	1.66	1.55	1.88	1.41	1.70	1.56	1.91	1.30	1.63	1.47	1.83	1.28	1.62	1.46	1.82
2.515	281749	M	1.53	1.92	1.68	1.98	1.50	1.88	1.67	2.04	—	—	—	—	—	—	—	—
		C	1.39	1.83	1.57	2.01	1.46	1.83	1.66	2.04	1.24	1.67	1.54	1.90	1.32	1.76	1.53	1.89
2.800	301848	M	1.51	1.86	1.73	2.06	1.54	1.87	1.75	2.10	—	—	—	—	—	—	—	—
		C	1.48	1.75	1.70	2.05	1.48	1.81	1.72	2.07	1.36	1.71	1.60	1.97	1.36	1.70	1.62	1.97
3.000	301846	M	1.53	1.86	1.78	2.10	1.55	1.89	1.80	2.17	—	—	—	—	—	—	—	—
		C	1.43	1.75	1.61	1.99	1.48	1.84	1.60	2.00	1.34	1.68	1.54	1.88	1.22	1.57	1.51	1.88

* C, center of thickness; M, midway between center and surface of plate.
** From Producer B; all others from Producer A.

TABLE XXI

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T851 PLATE

Sample: Thickness, in.	Sample: Number and Producer	Sample: Location*	Flatwise: BUS(L)/TUS(LT) e/D= 1.5	Flatwise: BUS(L)/TUS(LT) e/D= 2.0	Flatwise: BYS(L)/TYS(LT) e/D= 1.5	Flatwise: BYS(L)/TYS(LT) e/D= 2.0	Flatwise: BUS(LT)/TUS(LT) e/D= 1.5	Flatwise: BUS(LT)/TUS(LT) e/D= 2.0	Flatwise: BYS(LT)/TYS(LT) e/D= 1.5	Flatwise: BYS(LT)/TYS(LT) e/D= 2.0	Edgewise: BUS(L)/TUS(LT) e/D= 1.5	Edgewise: BUS(L)/TUS(LT) e/D= 2.0	Edgewise: BYS(L)/TYS(LT) e/D= 1.5	Edgewise: BYS(L)/TYS(LT) e/D= 2.0	Edgewise: BUS(LT)/TUS(LT) e/D= 1.5	Edgewise: BUS(LT)/TUS(LT) e/D= 2.0	Edgewise: BYS(LT)/TYS(LT) e/D= 1.5	Edgewise: BYS(LT)/TYS(LT) e/D= 2.0
0.250	252464A	C	1.57	2.00	1.54	1.84	1.57	2.00	1.52	1.87	—	—	—	—	—	—	—	—
0.312	281400	C	1.55	1.96	1.50	1.86	1.56	1.96	1.53	1.86	—	—	—	—	—	—	—	—
0.375	281271	C	1.57	1.97	1.57	1.78	1.56	1.96	1.54	1.78	—	—	—	—	—	—	—	—
0.440	281869**	C	1.57	2.00	1.53	1.72	1.56	1.96	1.53	1.74	—	—	—	—	—	—	—	—
0.499	301853	C	1.51	1.91	1.49	1.74	1.52	1.89	1.48	1.70	—	—	—	—	—	—	—	—
0.500	281758A	C	1.53	2.03	1.52	1.81	1.53	2.05	1.56	1.85	—	—	—	—	—	—	—	—
0.500	281662**	C	1.56	1.98	1.55	1.76	1.56	1.99	1.53	1.73	—	—	—	—	—	—	—	—
0.501	281368	C	1.51	1.95	1.47	1.75	1.53	1.95	1.49	1.73	—	—	—	—	—	—	—	—
0.567	281490	C	1.50	1.94	1.50	1.77	1.51	1.91	1.50	1.75	—	—	—	—	—	—	—	—
0.720	281402	C	1.52	1.92	1.50	1.74	1.53	1.93	1.51	1.76	—	—	—	—	—	—	—	—
0.750	281267	C	1.52	1.95	1.45	1.76	1.52	1.93	1.51	1.74	—	—	—	—	—	—	—	—
0.805	281658**	C	1.53	1.96	1.50	1.75	1.51	1.93	1.49	1.74	—	—	—	—	—	—	—	—
1.001	281376	C	1.51	1.92	1.47	1.74	1.51	1.90	1.47	1.71	—	—	—	—	—	—	—	—
1.009	281511	C	1.53	1.95	1.50	1.74	1.52	1.93	1.49	1.74	1.36	1.81	†	1.76	1.32	1.79	†	1.73
1.260	281412	C	1.53	1.94	1.50	1.75	1.51	1.92	1.49	1.73	1.54	1.77	1.44	1.80	1.34	1.81	1.45	1.79
1.500	251697A	C	1.49	1.98	1.44	1.69	1.54	1.97	1.48	1.70	1.52	1.76	1.41	1.73	1.28	1.75	†	1.68
2.001	281590	M	1.57	2.00	1.57	1.84	1.56	1.98	1.56	1.81	—	—	—	—	—	—	—	—
		C	1.51	1.91	1.52	1.76	1.57	1.98	1.57	1.80	—	—	—	—	—	—	—	—
2.250	281615	M	1.57	1.99	1.58	1.86	1.56	1.95	1.58	1.79	—	—	—	—	—	—	—	—
		C	1.53	1.93	1.51	1.80	1.51	1.96	1.51	1.79	—	—	—	—	—	—	—	—
2.250	301783	M	1.53	1.96	1.52	1.79	1.54	1.97	1.52	1.82	—	—	—	—	—	—	—	—
		C	1.51	1.92	1.49	1.75	1.51	1.92	1.50	1.78	1.27	1.74	†	1.76	1.28	1.68	†	1.72
2.515	281750	M	1.52	1.98	1.51	1.82	1.51	1.97	1.52	1.81	—	—	—	—	—	—	—	—
		C	1.46	1.93	1.45	1.77	1.47	1.94	1.46	1.82	1.26	1.75	†	1.78	1.26	1.75	†	1.76

* C, center of thickness; M, midway between center and surface of plate.
† Bearing specimen failed before reaching yield strength (2 per cent offset).
** From Producer B; all others from Producer A.

TABLE XXII

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF STRESS-RELIEVED STRETCHED 7175-T651 PLATE

Sample			Flatwise								Edgewise							
			BUS(L)/TUS(LT)		FYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		FYS(LT)/TYS(LT)		BUS(L)/TUS(LT)		FYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		FYS(LT)/TYS(LT)	
Thickness, in.	Number and Producer	Location*	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0
0.314	281404	C	1.56	1.93	.54	1.86	1.58	1.98	1.57	1.92	--	--	--	--	--	--	--	--
0.375	281505**	C	1.56	1.93	4.52	1.77	1.54	1.89	1.47	1.75	--	--	--	--	--	--	--	--
0.375	301874	C	1.54	1.90	1.54	1.69	1.54	1.90	1.53	1.75	--	--	--	--	--	--	--	--
0.420	281636	C	1.47	1.83	1.46	1.77	1.50	1.90	1.46	1.72	--	--	--	--	--	--	--	--
0.434	281596	C	1.56	1.94	1.52	1.75	1.56	1.93	1.59	1.80	--	--	--	--	--	--	--	--
0.500	270087	C	1.46	1.85	1.49	1.68	1.61	1.75	1.41	1.70	--	--	--	--	--	--	--	--
0.501	281504**	C	1.50	1.85	1.49	1.72	1.52	1.86	1.46	1.76	--	--	--	--	--	--	--	--
0.504	281414	C	1.46	1.80	1.41	1.65	1.49	1.75	1.43	1.70	--	--	--	--	--	--	--	--
0.505	281413	C	1.44	1.79	1.43	1.66	1.53	1.75	1.46	1.71	--	--	--	--	--	--	--	--
0.505	281509**	C	1.53	1.90	1.51	1.76	1.45	1.75	1.44	1.70	--	--	--	--	--	--	--	--
0.882	281484	C	1.47	1.85	1.47	1.73	1.55	1.85	1.49	1.73	--	--	--	--	--	--	--	--
1.142	281507**	C	1.49	1.93	1.46	1.74	1.51	1.87	1.51	1.79	1.40	1.66	1.53	1.84	1.41	1.86	1.52	1.83
1.250	281661	C	1.44	1.86	1.46	1.65	1.47	1.73	1.48	1.69	1.21	1.68	†	1.64	1.27	1.67	1.34	1.68
1.250	281364	C	1.47	1.85	1.44	1.69	1.54	1.79	1.49	1.76	1.39	1.80	1.44	1.75	1.40	1.77	1.41	1.70
1.625	281585	M	1.50	1.93	1.50	1.80	1.56	1.90	1.60	1.84	--	--	--	--	--	--	--	--
		C	1.44	1.78	1.45	1.67	1.46	1.80	1.48	1.72	1.28	1.69	1.39	1.68	1.29	1.67	1.37	1.66
2.001	281502**	M	1.53	1.96	1.49	1.85	1.59	2.04	1.64	1.96	--	--	--	--	--	--	--	--
		C	1.50	1.94	1.48	1.83	1.55	1.92	1.56	1.82	1.40	1.84	1.49	1.82	1.41	1.79	1.45	1.78
2.250	281417	M	1.62	1.98	1.50	1.76	1.58	1.94	1.56	1.82	--	--	--	--	--	--	--	--
		C	1.49	1.88	1.49	1.73	1.56	1.90	1.55	1.80	1.38	1.75	1.46	1.66	1.36	1.76	1.43	1.74
2.250	281654**	M	1.55	1.91	1.61	1.86	1.54	1.98	1.61	1.89	--	--	--	--	--	--	--	--
		C	1.44	1.81	1.47	1.71	1.46	1.85	1.49	1.74	1.33	1.72	1.42	1.69	1.35	1.77	1.42	1.70
2.269	281421	M	1.62	1.93	1.64	1.82	1.61	2.07	1.66	1.94	--	--	--	--	--	--	--	--
		C	1.50	1.84	1.51	1.76	1.47	1.85	1.46	1.77	1.41	1.76	1.42	1.73	1.36	1.80	1.39	1.75
2.501	301894	M	1.51	1.89	1.56	1.76	1.53	1.90	1.56	1.78	--	--	--	--	--	--	--	--
		C	1.47	1.85	1.50	1.69	1.46	1.88	1.48	1.73	1.36	1.76	1.45	1.62	1.21	1.68	1.39	1.64
2.501	301897	M	1.51	1.89	1.56	1.76	1.53	1.86	1.57	1.81	--	--	--	--	--	--	--	--
		C	1.49	1.82	1.47	1.69	1.49	1.83	1.48	1.72	1.26	1.69	1.38	1.63	1.28	1.67	1.40	1.66
2.773	281491	M	1.57	1.93	1.67	1.92	1.61	2.01	1.71	2.00	--	--	--	--	--	--	--	--
		C	1.53	1.86	1.61	1.84	1.54	1.88	1.80	1.91	1.31	1.75	†	1.85	1.33	1.76	1.51	1.81
3.025	281420	M	1.59	1.94	1.61	1.89	1.59	1.94	1.63	1.91	--	--	--	--	--	--	--	--
		C	1.50	1.86	1.56	1.77	1.55	1.84	1.55	1.80	1.34	1.73	1.47	1.71	1.37	1.72	1.46	1.73
3.953	281684	M	1.47	1.88	1.54	1.85	1.45	1.88	1.56	1.86	--	--	--	--	--	--	--	--
		C	1.45	1.91	1.54	1.86	1.47	1.92	1.53	1.87	1.32	1.81	1.46	1.84	1.31	1.79	1.45	1.80

* C, center of thickness; M, midway between center and surface of plate.
† Bearing specimen failed before reaching yield stress (2 per cent offset).
** From Producer B; all others from Producer A.

TABLE XXIII

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF STRESS-RELIEVED STRETCHED 7079-T651 PLATE

Sample: Thickness	Sample: Number and Producer	Sample: Location*	Flatwise: BUS(L)/TUS(LT) e/D=1.5	Flatwise: BUS(L)/TUS(LT) e/D=2.0	Flatwise: BYS(L)/TYS(LT) e/D=1.5	Flatwise: BYS(L)/TYS(LT) e/D=2.0	Flatwise: BUS(LT)/TUS(LT) e/D=1.5	Flatwise: BUS(LT)/TUS(LT) e/D=2.0	Flatwise: BYS(LT)/TYS(LT) e/D=1.5	Flatwise: BYS(LT)/TYS(LT) e/D=2.0	Edgewise: BUS(L)/TUS(LT) e/D=1.5	Edgewise: BUS(L)/TUS(LT) e/D=2.0	Edgewise: BYS(L)/TYS(LT) e/D=1.5	Edgewise: BYS(L)/TYS(LT) e/D=2.0	Edgewise: BUS(LT)/TUS(LT) e/D=1.5	Edgewise: BUS(LT)/TUS(LT) e/D=2.0	Edgewise: BYS(LT)/TYS(LT) e/D=1.5	Edgewise: BYS(LT)/TYS(LT) e/D=2.0
0.252	281406	C	1.58	2.02	1.54	1.86	1.62	2.04	1.56	1.88	--	--	--	--	--	--	--	--
0.315	281405	C	1.57	1.99	1.50	1.82	1.59	2.01	1.52	1.81	--	--	--	--	--	--	--	--
0.501	281390	C	1.52	1.88	1.51	1.73	1.52	1.84	1.51	1.78	--	--	--	--	--	--	--	--
0.625	281503‡‡	C	1.55	1.97	1.50	1.75	1.57	1.99	1.54	1.79	--	--	--	--	--	--	--	--
0.750	281676	C	1.52	2.00	1.49	1.78	1.58	2.03	1.52	1.83	--	--	--	--	--	--	--	--
1.008	281399	C	1.54	1.98	1.50	1.74	1.55	1.87	1.49	1.73	1.45	1.83	1.42	1.71	1.49	1.88	1.43	1.74
1.500	251698	C	1.46	1.88	1.45	1.67	1.50	1.87	1.46	1.71	1.40	1.82	1.43	1.72	1.41	1.81	1.40	1.67
1.635	281410	M	1.51	1.97	1.47	1.[illegible]	1.59	1.97	1.57	1.85	--	--	--	--	--	--	--	--
		C	1.53	1.58	1.48	1.[illegible]	1.60	1.87	1.56	1.77	1.51	1.79	1.49	1.76	1.61	1.80	1.58	1.74
2.000	281500‡‡	M	1.60	2.03	1.57	1.7[illegible]	1.52	2.02	1.58	1.81	--	--	--	--	--	--	--	--
		C	1.52	1.88	1.49	1.70	1.55	1.92	1.51	1.75	1.43	1.87	1.46	1.73	1.39	1.84	1.44	1.72
2.260	301876	M	1.60	2.02	1.63	1.82	1.63	2.03	1.62	1.81	--	--	--	--	--	--	--	--
		C	1.48	1.87	1.46	1.66	1.45	1.84	1.45	1.68	1.37	1.74	1.39	1.61	1.40	1.77	1.41	1.61
2.500	301877	M	1.59	1.95	1.59	1.76	1.61	2.01	1.58	1.76	--	--	--	--	--	--	--	--
		C	1.54	1.95	1.54	1.76	1.54	1.93	1.55	1.77	1.41	1.81	1.50	1.73	1.34	1.77	1.43	1.67
3.000	281842‡‡	M	1.58	1.98	1.59	1.83	1.59	1.99	1.59	1.84	--	--	--	--	--	--	--	--
		C	1.55	1.96	1.55	1.81	1.53	1.91	1.52	1.81	1.45	1.88	1.51	1.81	1.42	1.82	1.50	1.80
3.000	281554	M	1.61	2.03	1.62	1.88	1.64	2.06	1.64	1.89	--	--	--	--	--	--	--	--
		C	1.55	1.93	1.57	1 83	1.56	1.92	1.57	1.84	1.31	1.83	†	1.78	1.41	1.79	1.49	1.79
3.001	281392	M	1.71	2.09	1.61	1.81	1.73	2.14	1.62	1.84	--	--	--	--	--	--	--	--
		C	1.52	1.86	1.50	1.73	1.55	1.87	1.54	1.80	1.37	1.75	1.44	1.69	1.44	1.79	1.47	1.69
3.277	281582	M	1.59	2.01	1.62	1.88	1.62	2.06	1.63	1.90	--	--	--	--	--	--	--	--
		C	1.61	1.98	1.57	1.82	1.61	1.97	1.56	1.87	1.46	1.85	1.50	1.79	1.40	1.82	1.49	1.79
4.001	281492	M	1.62	2.02	1.64	1.88	1.63	2.01	1.65	1.90	--	--	--	--	--	--	--	--
		C	1.55	1.92	1.56	1.83	1.51	1.85	1.51	1.76	1.40	1.81	1.49	1.80	1.39	1.78	1.44	1.74
4.499	281393	M	1.56	1.92	1.59	1.84	1.64	1.99	1.60	1.88	--	--	--	--	--	--	--	--
		C	1.52	1.97	1.58	1.89	1.59	1.93	1.60	1.83	1.53	1.92	1.55	1.85	1.44	1.85	1.51	1.84
4.770	301879	M	1.57	1.99	1.63	1.84	1.60	2.02	1.65	1.90	--	--	--	--	--	--	--	--
		C	1.54	1.93	1.58	1.80	1.54	1.92	1.55	1.77	1.34	1.71	1.46	1.71	1.30	1.76	1.48	1.72
6.000	301878	M	1.61	1.99	1.66	1.93	1.59	2.00	1.67	1.96	--	--	--	--	--	--	--	--
		C	1.62	2.08	1.71	1.97	1.59	1.99	1.68	1.95	1.55	2.00	1.66	1.92	1.49	1.92	1.62	1.92

* C, center of thickness; M, midway between center and surface of plate.
† Bearing specimen failed before reaching yield stress (2 per cent offset).
‡‡ From Producer B; all others from Producer A.

TABLE XXIV

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF STRESS-RELIEVED STRETCHED 7178-T651 PLATE

Sample			Flatwise								Edgewise							
			BUS(L)/TUS(LT)		BYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		BYS(LT)/TYS(LT)		BUS(L)/TUS(LT)		BYS(L)/TYS(LT)		BUS(LT)/TUS(LT)		BYS(LT)/TYS(LT)	
Thickness, in.	Number and Producer	Location*	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0	e/D= 1.5	e/D= 2.0
0.250	252401	C	1.55	1.93	1.53	1.77	1.53	1.82	1.51	1.77	--	--	--	--	--	--	--	--
0.252	281415	C	1.57	1.96	1.60	1.92	1.55	1.90	1.59	1.84	--	--	--	--	--	--	--	--
0.276	301835	C	1.58	2.00	1.56	1.88	1.58	1.92	1.55	1.90	--	--	--	--	--	--	--	--
0.284	301861	C	1.54	1.94	1.59	1.88	1.56	1.90	1.58	1.90	--	--	--	--	--	--	--	--
0.312	281501**	C	1.57	1.94	1.63	1.87	1.57	1.97	1.63	1.91	--	--	--	--	--	--	--	--
0.403	281419	C	1.53	1.91	1.49	1.77	1.53	1.86	1.51	1.77	--	--	--	--	--	--	--	--
0.435	281403	C	1.56	1.92	1.56	1.83	1.57	1.90	1.54	1.81	--	--	--	--	--	--	--	--
0.435	301733***	C	1.54	1.92	1.53	1.80	1.54	1.89	1.55	1.82	--	--	--	--	--	--	--	--
0.500	251780	C	1.50	1.87	1.45	1.72	1.47	1.74	1.45	1.69	--	--	--	--	--	--	--	--
0.500	281663**	C	1.51	1.85	1.43	1.70	1.51	1.86	1.45	1.75	--	--	--	--	--	--	--	--
0.504	281416	C	1.47	1.86	1.44	1.68	1.52	1.84	1.46	1.72	--	--	--	--	--	--	--	--
0.504	281438	C	1.47	1.91	1.50	1.70	1.50	1.79	1.53	1.75	--	--	--	--	--	--	--	--
0.520	301734***	C	1.45	1.79	1.41	1.69	1.51	1.83	1.46	1.73	--	--	--	--	--	--	--	--
0.750	281734	C	1.49	1.92	1.47	1.75	1.48	1.85	1.46	1.78	--	--	--	--	--	--	--	--
1.000	251777	C	1.47	1.86	1.43	1.70	1.46	1.72	1.43	1.69	1.28	1.70	1.41	1.69	1.20	1.62	†	1.67
1.000	281657**	C	1.45	1.80	1.45	1.69	1.46	1.80	1.45	1.69	--	--	--	--	--	--	--	--
1.250	251736	C	1.40	1.74	1.46	1.73	1.41	1.72	1.44	1.75	1.25	1.63	1.35	1.71	1.17	1.59	†	1.66

* C, center of thickness; M, midway between center and surface of plate.
† Bearing specimen failed before reaching yield stress (2 per cent offset).
** From Producer B.
*** From Producer C.
All others from Producer A.

TABLE XXV

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Location	Flatwise BOS(L)/TUS(LT) e/D= 1.5	Flatwise BOS(L)/TUS(LT) e/D= 2.0	Flatwise BYS(L)/TYS(LT) e/D= 1.5	Flatwise BYS(L)/TYS(LT) e/D= 2.0	Flatwise BOS(LT)/TUS(LT) e/D= 1.5	Flatwise BOS(LT)/TUS(LT) e/D= 2.0	Flatwise BYS(LT)/TYS(LT) e/D= 1.5	Flatwise BYS(LT)/TYS(LT) e/D= 2.0	Edgewise BOS(L)/TUS(LT) e/D= 1.5	Edgewise BOS(L)/TUS(LT) e/D= 2.0	Edgewise BYS(L)/TYS(LT) e/D= 1.5	Edgewise BYS(L)/TYS(LT) e/D= 2.0	Edgewise BOS(LT)/TUS(LT) e/D= 1.5	Edgewise BOS(LT)/TUS(LT) e/D= 2.0	Edgewise BYS(LT)/TYS(LT) e/D= 1.5	Edgewise BYS(LT)/TYS(LT) e/D= 2.0
2014-T62	0.312	281363A	C	1.61	2.05	1.65	1.94	1.61	2.04	1.64	1.97	—	—	—	—	—	—	—	—
	0.550	281365A	C	1.54	1.97	1.52	1.76	1.56	1.99	1.52	1.79	—	—	—	—	—	—	—	—
	1.001	281366A	C	1.50	1.90	1.43	1.69	1.51	1.93	1.45	1.73	1.33	1.74	1.42	1.68	1.27	1.73	*	1.68
	2.500	281547A	N	1.57	1.99	1.56	1.83	1.57	1.98	1.55	1.84	—	—	—	—	—	—	—	—
			C	1.52	1.91	1.53	1.80	1.53	1.92	1.51	1.79	1.37	1.78	1.47	1.78	1.34	1.78	1.46	1.78
2024-T42	0.252	281433A	C	1.57	1.96	1.88	2.19	1.58	1.92	1.82	2.20	—	—	—	—	—	—	—	—
	0.501	281378A	C	1.58	1.79	1.77	2.06	1.54	1.86	1.80	2.08	—	—	—	—	—	—	—	—
	1.001	281377A	C	1.71	1.84	1.67	2.01	1.53	1.92	1.77	2.00	1.36	1.71	1.77	2.15	1.44	1.82	1.71	2.01
	2.001	281372A	N	1.52	1.79	1.81	2.03	1.54	1.88	1.82	2.15	—	—	—	—	—	—	—	—
			C	1.43	1.72	1.60	1.88	1.42	1.78	1.55	1.86	1.29	1.74	1.54	1.88	1.30	1.72	1.54	1.85
2024-T6	0.252	281433B	C	1.67	2.09	1.73	2.09	1.66	2.12	1.72	2.09	—	—	—	—	—	—	—	—
	0.501	281378B	C	1.58	2.01	1.66	1.98	1.59	2.01	1.66	1.97	—	—	—	—	—	—	—	—
	1.001	281377B	C	1.59	2.02	1.66	1.96	1.59	2.01	1.63	1.93	1.42	1.86	1.58	1.93	1.38	1.75	1.59	1.90
	2.001	281372B	N	1.60	2.00	1.66	1.96	1.60	2.03	1.66	1.95	—	—	—	—	—	—	—	—
			C	1.58	1.98	1.59	1.89	1.55	1.98	1.59	1.92	1.36	1.80	1.54	1.85	1.38	1.77	1.52	1.85
7075-T6	0.375	281381A	C	1.56	1.92	1.56	1.80	1.57	1.93	1.55	1.80	—	—	—	—	—	—	—	—
	0.519	301875A	C	1.56	1.93	1.54	1.73	1.59	1.92	1.57	1.76	—	—	—	—	—	—	—	—
	0.625	281382A	C	1.50	1.88	1.52	1.74	1.56	1.89	1.53	1.76	—	—	—	—	—	—	—	—
	1.500	281386A	C	1.45	1.79	1.42	1.63	1.47	1.78	1.43	1.66	1.34	1.69	1.41	1.58	1.27	1.73	1.39	1.61
	2.250	281388A	N	1.53	1.81	1.53	1.65	1.53	1.94	1.54	1.80	—	—	—	—	—	—	—	—
			C	1.48	1.83	1.48	1.68	1.51	1.88	1.49	1.72	1.37	1.78	1.43	1.67	1.41	1.79	1.42	1.64
	2.501	281383A	N	1.55	1.90	1.54	1.74	1.56	1.96	1.55	1.76	—	—	—	—	—	—	—	—
			C	1.52	1.89	1.51	1.74	1.53	1.90	1.52	1.76	1.39	1.72	1.45	1.69	1.38	1.78	1.44	1.67
	2.522	271418A	N	1.53	1.90	1.50	1.70	1.84	1.93	1.61	1.75	—	—	—	—	—	—	—	—
			C	1.49	1.83	1.52	1.75	1.54	1.86	1.59	1.78	1.36	1.69	1.45	1.69	1.36	1.71	1.43	1.71
	3.001	281387A	N	1.64	1.99	1.68	1.90	1.65	2.02	1.71	1.89	—	—	—	—	—	—	—	—
			C	1.53	1.87	1.58	1.75	1.61	1.94	1.61	1.84	1.35	1.72	1.48	1.73	1.39	1.73	1.49	1.70

—CONCLUDED ON NEXT PAGE—

TABLE XXV (CONCLUDED)

RATIOS OF BEARING PROPERTIES TO TENSILE PROPERTIES OF PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Sample† Location‡	Flatwise BUS(L)/TUS(LT) e/D= 1.5	Flatwise BUS(L)/TUS(LT) e/D= 2.0	Flatwise BYS(L)/TYS(LT) e/D= 1.5	Flatwise BYS(L)/TYS(LT) e/D= 2.0	Flatwise BUS(LT)/TUS(LT) e/D= 1.5	Flatwise BUS(LT)/TUS(LT) e/D= 2.0	Flatwise BYS(LT)/TYS(LT) e/D= 1.5	Flatwise BYS(LT)/TYS(LT) e/D= 2.0	Edgewise BUS(L)/TUS(LT) e/D= 1.5	Edgewise BUS(L)/TUS(LT) e/D= 2.0	Edgewise BYS(L)/TYS(LT) e/D= 1.5	Edgewise BYS(L)/TYS(LT) e/D= 2.0	Edgewise BUS(LT)/TUS(LT) e/D= 1.5	Edgewise BUS(LT)/TUS(LT) e/D= 2.0	Edgewise BYS(LT)/TYS(LT) e/D= 1.5	Edgewise BYS(LT)/TYS(LT) e/D= 2.0
7079-T6	0.252	281422A	C	1.64	2.05	1.62	1.90	1.65	2.07	1.61	1.91	—	—	—	—	—	—	—	—
	0.501	281389A	C	1.50	1.86	1.44	1.65	1.55	1.87	1.48	1.68	—	—	—	—	—	—	—	—
	1.001	281388A	C	1.55	1.94	1.51	1.65	1.50	1.88	1.45	1.64	1.47	1.86	1.44	1.73	1.48	1.85	1.42	1.66
	1.249	301857A	C	1.49	1.88	1.46	1.66	1.54	1.93	1.48	1.70	1.47	1.85	1.43	1.73	1.48	1.82	1.42	1.67
	1.500	301856A	C	1.57	1.96	1.51	1.72	1.51	1.96	1.44	1.70	1.46	1.88	1.47	1.72	1.43	1.86	1.44	1.66
	1.625	281391A	M	1.58	1.95	1.60	1.78	1.60	2.00	1.56	1.78	—	—	—	—	—	—	—	—
			C	1.52	1.90	1.49	1.67	1.54	1.92	1.46	1.71	1.41	1.79	1.45	1.65	1.48	1.79	1.44	1.68
	2.280	301858A	M	1.67	2.08	1.66	1.85	1.65	2.06	1.62	1.86	—	—	—	—	—	—	—	—
			C	1.54	1.92	1.49	1.71	1.53	1.93	1.48	1.71	1.44	1.80	1.43	1.69	1.39	1.78	1.41	1.63
	2.500	301859A	M	1.60	2.00	1.60	1.81	1.64	2.10	1.61	1.86	—	—	—	—	—	—	—	—
			C	1.55	1.92	1.53	1.74	1.57	2.01	1.52	1.77	1.43	1.79	1.48	1.73	1.37	1.78	1.46	1.72
	3.001	281423A	M	1.53	1.91	1.57	1.76	1.53	1.96	1.59	1.77	—	—	—	—	—	—	—	—
			C	1.50	1.87	1.51	1.73	1.52	1.91	1.50	1.76	1.36	1.80	1.45	1.69	1.40	1.77	1.46	1.67
	4.000	301860A	M	1.63	2.09	1.70	1.91	1.66	2.09	1.69	1.95	—	—	—	—	—	—	—	—
			C	1.53	1.92	1.54	1.77	1.57	1.91	1.59	1.81	1.35	1.70	1.45	1.70	1.34	1.72	1.44	1.70
	4.040	301850A	M	1.64	2.07	1.69	1.92	1.67	2.09	1.70	1.92	—	—	—	—	—	—	—	—
			C	1.55	1.94	1.54	1.76	1.54	1.96	1.54	1.77	1.36	1.76	1.46	1.72	1.37	1.77	1.46	1.71
	4.800	301851A	M	1.64	2.08	1.70	1.96	1.66	2.08	1.71	1.94	—	—	—	—	—	—	—	—
			C	1.54	1.94	1.56	1.73	1.52	1.92	1.53	1.75	1.42	1.78	1.49	1.72	1.37	1.79	1.45	1.72
7178-T6	0.250	301880A	C	1.55	1.94	1.60	1.88	1.57	1.98	1.60	1.91	—	—	—	—	—	—	—	—
	0.252	281421A	C	1.56	1.95	1.64	1.94	1.56	1.95	1.64	1.92	—	—	—	—	—	—	—	—
	0.633	301896A	C	1.47	1.84	1.43	1.65	1.48	1.75	1.41	1.65	—	—	—	—	—	—	—	—

* Bearing specimen failed before reaching yield strength (2 per cent offset).
† All samples received in the -O or -F temper from Producer A and heat treated to the "heat-treated-by-user" temper by Alcoa Research Laboratories.
‡ C, center of thickness; M, midway between center and surface of plate.

TABLE XXVI

AVERAGE RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES* OF 2014 PLATE

Temper	Thickness Range, in.	Number of Samples	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	CYS(LT)/TYS(LT)	SS(Av)/TS(LT)	BUS(L or LT)/TUS(LT) e/D= 1.5	BUS(L or LT)/TUS(LT) e/D= 2.0	BYS(L or LT)/TYS(LT) e/D= 1.5	BYS(L or LT)/TYS(LT) e/D= 2.0
			Tests on Contract AF33(657)-7837								
-T651	0.250-0.499	4	0.99	1.03	1.02	1.07	0.62	1.60	2.04	1.56	1.86
	0.500-1.000	6	0.99	1.02	0.98	1.04	0.61	1.57	2.01	1.52	1.80
	1.001-1.500	3	1.00	1.02	1.00	1.03	0.58	1.56	1.98	1.52	1.78
	1.501-2.000	3	1.01	1.05	1.01	1.05	0.61	1.62	2.06	1.60	1.87
	2.001-3.000	3	1.00	1.03	0.99	1.04	0.61	1.60	2.04	1.57	1.85
-T6*	0.250-0.499	1	0.97	1.00	1.07	1.07	0.62	1.61	2.04	1.64	1.96
	0.500-1.000	1	0.98	0.99	1.05	1.06	0.60	1.55	1.98	1.52	1.78
	1.001-1.500	1	0.98	0.98	1.03	1.04	0.56	1.50	1.92	1.44	1.71
	2.001-3.000	1	0.97	0.97	1.00	1.01	0.60	1.57	1.98	1.56	1.84
			MIL-HDBK-5								
-T6	0.250-0.499	-	1.01	1.02	1.02†	1.03	0.61	1.52	1.93	1.42	1.63
	0.500-1.000	-	1.01	1.02	1.02†	1.03	0.61	1.52	1.93	1.42	1.63
	1.001-1.500	-	1.00	1.00	1.03†	1.03	0.61	1.51	1.90	1.41	1.59
	1.501-2.000	-	1.00	1.00	1.03†	1.03	0.62	1.51	1.91	1.41	1.59
	2.001-3.000	-	1.00	1.00	1.04†	1.04	0.62	1.41	2.05	1.40	1.60

* Heat treated by user.
† For -T651 temper, ratio may be lower.
‡ At location stated in specification for tensile properties.

TABLE XXVII

AVERAGE RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES‡ OF 2024 PLATE

Temper	Thickness Range, in.	Number of Samples	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	CYS(LT)/TYS(LT)	SS(Av)/TS(LT)	BUS(L or LT)/TUS(LT) e/D=1.5	BUS(L or LT)/TUS(LT) e/D=2.0	BYS(L or LT)/TYS(LT) e/D=1.5	BYS(L or LT)/TYS(LT) e/D=2.0
			Tests on Contract AF33(657)-7837								
-T351	0.250-0.499	8	1.02	1.17	0.98	1.10	0.62	1.58	1.93	1.81	2.18
	0.500-1.000	8	1.01	1.15	0.93	1.07	0.60	1.53	1.87	1.74	2.06
	1.001-1.500	5	1.01	1.13	0.93	1.07	0.57	1.50	1.84	1.65	1.99
	1.501-2.000	3	1.03	1.14	0.93	1.06	0.63	1.55	1.90	1.76	2.12
	2.001-3.000	6	1.02	1.13	0.92	1.06	0.62	1.55	1.88	1.77	2.13
-T42*	0.250-0.499	1	1.02	1.03	1.08	1.06	0.62	1.58	1.94	1.85	2.20
	0.500-1.000	1	1.00	1.02	1.07	1.06	0.61	1.51	1.82	1.78	2.07
	1.001-1.500	1	0.99	1.00	1.04	1.06	0.60	1.47	1.88	1.72	2.00
	2.001-3.000	1	1.01	1.01	1.07	1.07	0.63	1.53	1.84	1.82	2.08
-T62*	0.250-0.499	1	1.01	1.02	1.05	1.05	0.62	1.66	2.10	1.72	2.09
	0.500-1.000	1	1.01	1.01	1.04	1.04	0.60	1.58	2.01	1.66	1.98
	1.001-1.500	1	1.00	1.00	1.05	1.05	0.60	1.59	2.02	1.64	1.94
	2.001-3.000	1	0.99	0.99	1.02	1.03	0.60	1.60	2.02	1.66	1.96
-T851	0.250-0.499	5	1.01	1.01	1.01	1.02	0.57	1.55	1.96	1.52	1.79
	0.500-1.000	7	1.00	1.02	1.01	1.02	0.58	1.53	1.96	1.50	1.76
	1.001-1.500	4	1.01	1.02	1.01	1.01	0.57	1.52	1.94	1.48	1.72
	2.001-3.000	4	1.00	1.01	0.97	1.00	0.58	1.54	1.98	1.54	1.82
			MIL-HDBK-5								
-T4	0.250-0.500	-	1.02	1.15	0.95†	1.08	0.62	1.53	1.94	1.60	1.85
	0.501-1.000	-	1.02	1.10	0.95†	1.08	0.61	1.53	1.94	1.55	1.75
	1.001-2.000	-	1.02	1.05	0.95†	1.05	0.60	1.53	1.93	1.50	1.70
	2.001-3.000	-	—	--	--	--	—	--	--	--	--
-T42*	0.250-0.500	-	1.00	1.00	1.00	1.00	0.59	1.50	1.91	1.39	1.61
	0.501-1.000	-	1.00	1.00	1.00	1.00	0.60	1.50	1.90	1.39	1.61
	1.001-2.000	-	1.00	1.00	1.00	1.00	0.60	1.50	1.90	1.39	1.61
	2.001-3.000	-	1.00	1.00	1.00	1.00	0.61	1.50	1.89	1.39	1.61

* Heat treated by user.
† For -T351 temper, ratio may be lower.
‡ At location stated in specification for tensile properties.

TABLE XXVIII

AVERAGE RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES† OF 7075 PLATE

Temper	Thickness Range, in.	Number of Samples	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	CYS(LT)/TYS(LT)	SS(Av)/TS(LT)	BUS(L or LT)/TUS(LT) e/D= 1.5	BUS(L or LT)/TUS(LT) e/D= 2.0	BYS(L or LT)/TYS(LT) e/D= 1.5	BYS(L or LT)/TYS(LT) e/D= 2.0
			Tests on Contract AF33(657)-7837								
-T651	0.250-0.499	5	0.99	1.04	1.02	1.08	0.58	1.54	1.94	1.53	1.81
	0.500-1.000	6	1.01	1.04	1.00	1.06	0.56	1.50	1.81	1.46	1.71
	1.001-2.000	4	1.01	1.05	1.01	1.07	0.57	1.51	1.85	1.50	1.76
	2.001-2.500	4	0.99	1.04	0.99	1.07	0.60	1.58	1.95	1.60	1.85
	2.501-3.000	3	0.98	1.03	0.97	1.07	0.60	1.54	1.91	1.61	1.84
	3.001-4.000	2	0.98	1.02	0.96	1.07	0.62	1.52	1.91	1.58	1.89
-T6*	0.250-0.499	2	0.98	1.01	1.09	1.08	0.59	1.57	1.92	1.56	1.77
	0.500-1.000	1	0.98	0.99	1.06	1.06	0.56	1.53	1.88	1.52	1.75
	1.001-2.000	1	1.00	0.99	1.03	1.04	0.54	1.46	1.78	1.42	1.64
	2.001-2.500	1	0.95	0.94	1.03	1.03	0.60	1.53	1.88	1.54	1.72
	2.501-3.000	2	0.94	0.94	0.99	1.02	0.59	1.57	1.92	1.55	1.74
	3.001-4.000	1	1.00	1.00	1.05	1.06	0.61	1.64	2.00	1.70	1.90
			MIL-HDBK-5								
-T6	0.250-0.500	-	1.00	1.02	1.05‡	1.05	0.60	1.40	1.81	1.32	1.52
	0.501-1.000	-	1.03	1.05	1.05‡	1.05	0.61	1.43	1.84	1.36	1.58
	1.001-2.000	-	1.01	1.03	1.03‡	1.03	0.60	1.42	1.82	1.33	1.55
	2.001-2.500	-	1.00	1.00	1.05‡	1.05	0.59	1.40	1.79	1.31	1.50
	2.501-3.000	-	1.00	1.00	1.05‡	1.05	0.59	1.40	1.80	1.30	1.50
	3.001-3.500	-	1.00	1.00	1.07	1.07	0.59	1.40	1.79	1.29	1.50
	3.501-4.000	-	1.00	1.00	1.07	1.07	0.59	1.42	1.80	1.30	1.50

* Heat treated by user.
‡ For -T651 temper, ratio is 1.00.
† At location stated in specification for tensile properties.

TABLE XXIX

AVERAGE RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES† OF 7079 PLATE

Temper	Thickness Range, in.	Number of Samples	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	CYS(LT)/TYS(LT)	SS(Av)/TS(LT)	BUS(L or LT)/TUS(LT) e/D= 1.5	BUS(L or LT)/TUS(LT) e/D= 2.0	BYS(L or LT)/TYS(LT) e/D= 1.5	BYS(L or LT)/TYS(LT) e/D= 2.0
			Tests on Contract AF33(657)-7837								
-T651	0.250-1.500	7	1.00	1.04	1.01	1.06	0.57	1.55	1.95	1.51	1.78
	1.501-2.000	2	0.98	1.02	1.00	1.07	0.60	1.56	2.00	1.55	1.80
	2.001-2.500	2	0.97	1.02	0.99	1.05	0.61	1.60	2.00	1.60	1.79
	2.501-3.000	2	0.97	1.00	0.98	1.06	0.62	1.60	2.02	1.61	1.86
	3.001-4.000	2	1.00	1.01	0.98	1.06	0.64	1.66	2.08	1.62	1.86
	4.001-4.500	2	0.98	1.02	0.99	1.06	0.62	1.61	1.98	1.62	1.88
	4.501-5.000	1	0.97	1.01	0.98	1.04	0.63	1.58	2.00	1.64	1.87
	5.501-6.000	1	1.01	1.05	0.99	1.06	0.64	1.60	2.00	1.66	1.94
-T6*	0.250-1.500	5	1.00	1.00	1.06	1.06	0.57	1.55	1.94	1.50	1.72
	1.501-2.000	1	0.99	0.99	1.04	1.07	0.61	1.59	1.98	1.58	1.78
	2.001-2.500	2	0.98	0.98	1.06	1.08	0.61	1.64	2.06	1.62	1.84
	3.001-4.000	2	0.96	0.96	1.01	1.07	0.62	1.59	2.01	1.64	1.85
	4.001-4.500	1	0.97	0.98	1.06	1.08	0.63	1.66	2.08	1.70	1.92
	4.501-5.000	1	0.98	0.98	1.04	1.07	0.62	1.65	2.08	1.70	1.95
			MIL-HDBK-5								
-T6 or -T651	0.250-1.000	-	1.01	1.03	1.00	1.05	0.61	1.42	1.82	1.35	1.57
	1.001-1.500	-	1.01	1.03	1.00	1.05	0.60	1.42	1.82	1.36	1.58
	1.501-2.000	-	1.00	1.00	1.00	1.05	0.60	1.40	1.79	1.34	1.55
	2.001-2.500	-	1.00	1.00	1.00	1.05	0.60	1.40	1.79	1.33	1.56
	2.501-3.000	-	1.00	1.00	1.00	1.05	0.60	1.44	1.86	1.32	1.52
	3.001-4.000	-	1.00	1.00	1.00	1.05	0.60	1.40	1.80	1.30	1.50
	4.001-4.500	-	1.00	1.00	1.00	1.05	0.60	1.40	1.79	1.29	1.50
	4.501-5.000	-	1.00	1.00	1.00	1.05	0.60	1.40	1.79	1.29	1.50
	5.501-6.000	-	1.00	1.00	1.00	1.05	0.61	1.39	1.80	1.30	1.51

* Heat treated by user.
† At location stated in specification for tensile properties.

TABLE XXX

AVERAGE RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES‡ OF 7178 PLATE

Temper	Thickness Range, in.	Number of Samples	TUS(L)/TUS(LT)	TYS(L)/TYS(LT)	CYS(L)/TYS(LT)	CYS(LT)/TYS(LT)	SS(Av)/TS(LT)	BUS(L or LT)/TUS(LT) e/D= 1.5	BUS(L or LT)/TUS(LT) e/D= 2.0	BYS(L or LT)/TYS(LT) e/D= 1.5	BYS(L or LT)/TYS(LT) e/D= 2.0
			Tests on Contract AF33(657)-7837								
-T651	0.250-0.499	8	0.99	1.05	1.03	1.09	0.59	1.55	1.93	1.56	1.85
	0.500-1.000	8	1.00	1.03	1.00	1.05	0.56	1.50	1.82	1.46	1.71
	1.001-1.500	1	1.00	1.02	0.99	1.04	0.52	1.40	1.73	1.45	1.74
-T6*	0.250-0.499	2	1.00	1.04	1.11	1.08	0.60	1.56	1.96	1.62	1.91
	0.500-1.000	1	1.02	1.02	1.07	1.07	0.55	1.48	1.80	1.42	1.65
			MIL-HDBK-5								
-T6	0.250-0.499	-	1.00	1.01	1.01†	1.04	0.60	1.40	1.80	1.32	1.52
	0.500-1.000	-	1.00	1.03	1.01†	1.04	0.60	1.40	1.80	1.33	1.53
	1.001-1.500	-	1.00	1.03	1.01†	1.04	0.60	1.40	1.80	1.32	1.52

* Heat treated by user.
† For -T651 temper, ratio may be lower.
‡ At location stated in specification for tensile properties.

TABLE XXXI

STATISTICAL ANALYSES OF RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND FLATWISE BEARING PROPERTIES OF STRESS-RELIEVED STRETCHED 2014-T651 PLATE

Ratio Cell	TUS (L) / TUS (LT)	TYS (L) / TYS (LT)	CYS (L) / TYS (LT)	CYS (LT) / TYS (LT)
1.10				1†
1.09				-
1.08				-
1.07			1†	1
1.06		1		2
1.05		1		6
1.04		3		4
1.03		5		5
1.02		8	2	
1.01	6	1	3	
1.00	3		3	
0.99	5		4	
0.98	4		5	
0.97	1		1	
n	19	19	18	18
$\bar{R}$	0.995	1.029	0.994	1.044
$\sigma_{\bar{R}}$	0.00261‡	0.00279	0.00348	0.00278
Min $\bar{R}$	0.981-1.011	1.023	0.987	1.038

Ratio Cell	SU (L) / TUS (LT)	SU (LT) / TUS (LT)	SU* (L+LT) / TUS (LT)
0.64	1		1
0.63	4	1	5
0.62	4	2	6
0.61	3	7	10
0.60	4	3	7
0.59	2	3	5
0.58	1	2	3
0.57	-	1	1
n	19	19	38
$\bar{R}$	0.612	0.602	0.607
$\sigma_{\bar{R}}$	0.00376	0.00348	0.00266
Min $\bar{R}$	0.604	0.595	0.602

e/D=1.5

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.64	1	1	2			
1.63	3	2	5			
1.62	1	1	2	1	1	2
1.61	1	2	3	1	3	4
1.60	2	4	6	3	1	4
1.59	-	1	1	1	2	3
1.58	5	2	7	-	2	2
1.57	1	2	3	2	1	3
1.56	2	1	3	-	1	1
1.55	1	-	1	3	-	3
1.54	1	1	2	-	1	1
1.53	1	1	2	-	1	1
1.52		-	-	2	1	3
1.51		1	1	2	1	3
1.50				1	1	2
1.49				-	1	1
1.48				-	1	1
1.47				1	-	1
1.46				1	1	2
1.45				1	-	1
n	19	19	38	19	19	38
$\bar{R}$	1.588	1.588	1.588	1.545	1.555	1.550
$\sigma_{\bar{R}}$	0.00747	0.00800	0.00540	0.01206	0.01149	0.00827
Min $\bar{R}$	1.572	1.571	1.577	1.520	1.531	1.533

e/D=2.0

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)
2.08	1	2	3
2.07	2	-	2
2.06	-	1	1
2.05	1	1	2
2.04	4	4	8
2.03	2	2	4
2.02	1	2	3
2.01	1	3	4
2.00	2	-	2
1.99	2	1	3
1.98	-	1	1
1.97	2	-	2
1.96	-	1	1
1.95	-	1	1
1.94	-	-	-
1.93	1	-	1
n	19	19	38
$\bar{R}$	2.019	2.023	2.021
$\sigma_{\bar{R}}$	0.00279	0.00412	0.00593
Min $\bar{R}$	2.013	2.006	2.009

Ratio Cell	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.92	-	2	2
1.91	2	-	2
1.90	-	1	1
1.89	2	-	2
1.88	1	2	3
1.87	1	3	4
1.86	-	-	-
1.85	2	2	4
1.84	1	2	3
1.83	-	-	-
1.82	1	-	1
1.81	-	2	2
1.80	2	-	2
1.79	1	2	3
1.78	-	-	-
1.77	-	2	2
1.76	2	-	2
1.75	1	-	1
1.74	2	1	3
1.71	1	-	-
n	19	19	38
$\bar{R}$	1.819	1.841	1.830
$\sigma_{\bar{R}}$	0.01459	0.01197	0.00947
Min $\bar{R}$	1.788	1.816	1.811

* Student's "t"-test showed no significant difference between average ratios for L and LT directions.
† Omitted.
‡ Regression analysis showed significant relationship with thickness. Value shown is $\sigma_e/\sqrt{n}$.

TABLE XXXII

STATISTICAL ANALYSES OF RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND FLATWISE BEARING PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T351 PLATE

Ratio Cell	TUS (L) / TUS (LT)	CYS (L) / TYS (LT)
1.07	1	
1.06	-	
1.05	2	
1.04	-	
1.03	4	
1.02	6	1
1.01	9	-
1.00	4	-
0.99	3	1
0.98	1	2
0.97		2
0.96		4
0.95		3
0.94		1
0.93		5
0.92		4
0.91		7
0.90		2
n	30	30
$\bar{R}$	1.015	0.939
σ_R	0.00350	0.004834
Min $\bar{R}$	1.008	0.934 0.946

Ratio Cell	TYS (L) / TUS (LT)	CYS (LT) / TYS (LT)
1.22	1	
1.21	-	
1.20	2	
1.19	1	
1.18	1	
1.17	2	1
1.16	6	-
1.15	5	-
1.14	5	-
1.13	3	-
1.12	3	-
1.11	2	-
1.10	2	2
1.09		1
1.08		5
1.07		5
1.06		6
1.05		1
1.04		1
1.03		1
n	30	30
$\bar{R}$	1.147	1.078
σ_R	0.00562*	0.00479*
Min $\bar{R}$	1.100 1.148	1.035 1.075

Ratio Cell	SU (L) / TUS (LT)	SU (LT) / TUS (LT)	SU* (L+LT) / TUS (LT)
0.66	1		1
0.65	-		-
0.64	2		4
0.63	9		9
0.62	5	2	17
0.61	2	12	15
0.60	4	3	7
0.59	3	3	7
0.58	1	1	4
0.57	1	4	5
0.56		1	1
0.55		1	
n	30	30	60
$\bar{R}$	0.611	0.602	0.607
σ_R	0.00461	0.00461	0.00329
Min $\bar{R}$	0.602	0.593	0.600

e/D=1.5

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)
1.63		1
1.62		2
1.61		1
1.60		-
1.59	3	3
1.58	2	1
1.57	2	1
1.56	1	2
1.55	5	6
1.54	1	4
1.53	1	1
1.52	1	2
1.51	3	3
1.50	1	1
1.49	3	1
1.48	1	
1.47	-	
1.46	-	
1.45	-	
1.44	-	
1.43	-	
1.42	-	
1.41	1	
n	29	29
$\bar{R}$	1.530	1.554
σ_R	0.00792	0.00692
Min $\bar{R}$	1.514§	1.540

Ratio Cell	BYS (L) / TUS (LT)	BYS (LT) / TUS (LT)	BYS* (L+LT) / TUS (LT)
1.90	1	1	2
1.89	-	1	1
1.88	-	-	-
1.87	-	1	2
1.86	1	-	1
1.85	1	1	2
1.84	2	-	2
1.83	1	2	3
1.82	2	-	2
1.81	1	2	3
1.80	2	-	2
1.79	1	1	2
1.78	3	2	5
1.77	1	-	1
1.76	1	2	3
1.75	2	1	3
1.74	1	1	2
1.73	1	-	1
1.72	1	2	3
1.71	3	2	5
1.70	1	1	2
1.69	-	1	1
1.68	1	2	3
1.67	2	1	3
1.66	1	1	2
1.65	2	-	2
1.64	1	1	2
1.63	-	1	1
1.62	1	-	1
1.61	-	1	1
1.60	1	-	1
n	29	29	58
$\bar{R}$	1.747	1.759	1.753
σ_R	0.01379	0.01483	0.01006
Min $\bar{R}$	1.719	1.729	1.733

e/D=2.0

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)
1.99		3
1.98	1	-
1.97	-	1
1.96	2	-
1.95	1	2
1.94	2	3
1.93	1	1
1.92	4	6
1.91	2	2
1.90	2	3
1.89	5	1
1.88	1	1
1.87	3	-
1.86	1	1
1.85	1	-
1.84	-	1
1.83	1	-
1.82	1	-
1.81	1	1
1.80	-	-
1.79	-	-
1.78	-	-
1.77	-	-
1.76	-	-
1.75	1	-
n	29	29
$\bar{R}$	1.874	1.906
σ_R	0.00999	0.00811
Min $\bar{R}$	1.854§	1.889

Ratio Cell	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
2.28		1	1
2.27		-	-
2.26		1	1
2.25		-	-
2.24	1	2	2
2.23	-	1	1
2.22	2	1	3
2.21	-	1	1
2.20	1	1	2
2.19	-	1	1
2.18	1	1	2
2.17	1	-	1
2.16	-	1	1
2.15	1	2	3
2.14	-	1	1
2.13	1	-	1
2.12	1	1	2
2.11	1	3	4
2.10	-	1	1
2.09	2	2	4
2.08	1	2	3
2.07	2	1	3
2.06	1	1	2
2.05	1	1	2
2.04	-	1	1
2.03	1	-	1
2.02	-	1	1
2.01	1	-	1
2.00	-	1	1
1.99	1	-	1
1.98	-	1	1
1.97	1	-	1
1.96	-	1	1
1.95	2	-	2
1.94	1	1	2
1.93	1	1	2
1.89	1	-	1
n	29	29	58
$\bar{R}$	2.078	2.122	2.100
σ_R	0.01717	0.01749	0.01250
Min $\bar{R}$	2.043	2.086	2.075

* Student's t-test showed no significant difference between average ratios for L and LT directions.

* Regression analysis showed significant relationship with thickness. Value shown is $\sigma_R/\sqrt{n}$.

§ Use this lower value. Student's t-test showed significant difference between average ratios for L and LT directions.

TABLE XXXIII

STATISTICAL ANALYSES OF RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND FLATWISE BEARING PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T851 PLATE

Ratio Cell	TUS (L) / TUS (LT)	TYS (L) / TYS (LT)	CYS (L) / CYS (LT)	CYS (LT) / TYS (LT)
1.01		1		2
1.02		1	1	1
1.03		1	2	5
1.04	1	1	3	3
1.05	10	1	1	3
1.06	7	1	3	1
0.95	2		2	
0.96			2	
0.97				
0.98				
n	20	20	20	20
$\bar{R}$	1.005	1.016	1.002	1.017
$\sigma_{\bar{R}}$	0.00172	0.00272	0.00331‡	0.00324‡
Min $\bar{R}$	1.001	1.010	1.001-1.013	1.013-1.018

Ratio Cell	SU (L) / TUS (LT)	SU (LT) / TUS (LT)	SU* (L+LT) / TUS (LT)
0.60	2	1	3
0.59	3	3	6
0.58	6	6	12
0.57	7	7	14
0.56	1	2	3
0.55	-	-	-
0.54	1	1	2
n	20	20	40
$\bar{R}$	0.577	0.575	0.576
$\sigma_{\bar{R}}$	0.00308	0.00290	0.00206
Min $\bar{R}$	0.571	0.569	0.572

e/D=1.5

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.58				1	1	2
1.57	5	1	6	2	-	2
1.56	1	6	7	-	2	2
1.55	1	1	2	-	-	-
1.54	-	2	2	1	1	2
1.53	5	2	7	3	3	6
1.52	3	5	8	1	3	4
1.51	1	2	3	6	1	7
1.50	1	1	2	1	4	5
1.49				2	1	3
1.48						
1.47						
1.46				1	1	2
1.45				1		1
1.44						
n	20	20	40	20	20	40
$\bar{R}$	1.535	1.536	1.535	1.510	1.515	1.513
$\sigma_{\bar{R}}$	0.00579	0.00514	0.00380	0.00842	0.00664	0.00531
Min $\bar{R}$	1.523	1.525	1.527	1.492	1.501	1.502

e/D=2.0

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)
2.05		1	1
2.04		-	-
2.03	1	1	2
2.02	-	-	-
2.01	-	1	1
2.00	1	3	4
1.99	2	1	3
1.98	3	3	6
1.97	4	4	8
1.96	3	2	5
1.95	2	4	6
1.94	2	1	3
1.93	4	1	5
1.92	2	2	4
1.91	1	2	3
1.90	1	1	2
1.89		1	1
n	20	20	40
$\bar{R}$	1.965	1.953	1.959
$\sigma_{\bar{R}}$	0.00699	0.00834	0.00547
Min $\bar{R}$	1.950	1.936	1.948

Ratio Cell	TYS (L) / TYS (LT)	TYS (LT) / TYS (LT)	TYS* (L+LT) / TYS (LT)
1.87		1	1
1.86	2	1	3
1.85	-	1	1
1.84	2	-	2
1.83	-	-	-
1.82	1	1	2
1.81	1	2	3
1.80	-	-	-
1.79	1	1	2
1.78	1	1	2
1.77	1	-	1
1.76	1	1	2
1.75	3	1	4
1.74	5	3	8
1.73	-	3	3
1.72	1	-	1
1.71	-	1	1
1.70	-	2	2
1.69	1	-	1
n	20	20	40
$\bar{R}$	1.776	1.768	1.772
$\sigma_{\bar{R}}$	0.01075	0.01178	0.00788
Min $\bar{R}$	1.754	1.743	1.756

* Student's t-test showed no significant difference between average ratios for L and LT directions.

‡ Regression analysis showed significant relationship with thickness. Value shown is $\sigma_0/\sqrt{n}$.

TABLE XXXIV

STATISTICAL ANALYSES OF RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND FLATWISE BEARING PROPERTIES OF STRESS-RELIEVED STRETCHED 7075-T651 PLATE

Ratio Cell	TUS (L) / TUS (LT)	TUS (ST) / TUS (LT)	TYS (L) / TYS (LT)	TYS (ST) / TYS (LT)	CYS (L) / TYS (LT)	CYS (LT) / TYS (LT)	CYS (BF) / TYS (LT)
1.10						2	
1.08							
1.06						1	
1.04			1			1	
1.02	1		2			1	
1.00	2		1		4	1	1
0.98	1		2		3		2
0.96	2	1			2		
0.94		1		2	1		
0.92		1		1			
0.90							
0.88							
0.86							
0.84							
0.82							
0.80							
0.78							
0.76							
n	24	9	24	9	24	24	9
$\bar{R}$	0.997	0.919	1.040	0.911	0.998	1.067	1.037
$\sigma_{\bar{R}}$	0.000418	0.01006	0.00387	0.00927	0.00474*	0.00375	0.00687
Min $\bar{R}$	0.988	0.896	1.032	0.890	0.990-1.006	1.059	1.022

Ratio Cell	SU (L) / TUS (LT)	SU (LT) / TUS (LT)	SU* (L+LT) / TUS (LT)
0.63	1		1
0.62	3		3
0.61	2	1	3
0.60	6	3	9
0.59	2	4	6
0.58	2	1	3
0.57	3	2	5
0.56	3		5
0.55	1	1	2
n	24	24	48
$\bar{R}$	0.590	0.579	0.585
$\sigma_{\bar{R}}$	—	—	0.00302*
Min $\bar{R}$	—	—	0.562-0.614

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.71					1	1
1.70						
1.69						
1.68						
1.67				1		1
1.66						
1.65	1		1		2	1
1.64	1		1		1	1
1.63	2	2	4	1	1	2
1.62	1	2	3		2	2
1.61	1	1	2	1	1	2
1.60	2	1	3	1	1	2
1.59	2	2	4	1	2	3
1.58	1	1	2	1	1	2
1.57	3	1	4	1	2	3
1.56	2	1	3	1	1	2
1.55	2	2	4	1	2	3
1.54	2	1	3	1	1	2
1.53	2	2	4	2	2	4
1.52	2	1	3	2	1	3
1.51	2	2	4	2	2	4
1.50	2	2	4	2	2	4
1.49	2	2	4	2	2	4
1.48	2	2	4	2	2	4
1.47	2	1	3	2	1	3
1.46	2	2	4	2	2	4
1.45	2	2	4	2	2	4
1.44	2	2	4	2	2	4
1.43	2	1	3	2	1	3
1.42	2	1	3	1	1	2
1.41	2	2	4	1	2	3
n	24	24	48	24	24	48
$\bar{R}$	1.522	1.538	1.530	1.529	1.535	1.532
$\sigma_{\bar{R}}$	0.01132	0.00881	0.00720	—	—	0.00655*
Min $\bar{R}$	1.495	1.520	1.516	—	—	1.488-1.616

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)
2.01		1	1
2.00		1	1
1.99		1	1
1.98	3	1	4
1.97	1	1	2
1.96	2	2	4
1.95	3	4	7
1.94	1	1	2
1.93	3	1	4
1.92	1	1	2
1.91	2	2	4
1.90	1	1	2
1.89	2	1	3
1.88	1	1	2
1.87	2	2	4
1.86	1	1	2
1.85	2	2	4
1.84	1	1	2
1.83	2	2	4
1.82	1	1	2
1.81			
1.80			
1.79	1	1	2
1.78			
1.77			
1.76			
1.75		2	2
1.74			
1.73		2	2
n	24	24	48
$\bar{R}$	1.902	1.879	1.890
$\sigma_{\bar{R}}$	0.01087	0.01741	0.01033
Min $\bar{R}$	1.880	1.843	1.869

Ratio Cell	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
2.00		1	1
1.99			
1.98			
1.97			
1.96			
1.95	1		1
1.94			
1.93			
1.92			
1.91			
1.90			
1.89			
1.88			
1.87			
1.86			
1.85			
1.84			
1.83			
1.82			
1.81			
1.80			
1.79			
1.78			
1.77			
1.76			
1.75			
1.74			
1.73			
1.72			
1.71			
1.70			
1.69			
1.68			
1.67			
1.66			
1.65			
n	24	24	48
$\bar{R}$	1.775	1.808	1.791
$\sigma_{\bar{R}}$	—	—	0.01042*
Min $\bar{R}$	—	—	1.725-1.874

* Student's "t"-test showed no significant difference between average ratios for L and LT directions.
\# Regression analysis showed significant relationship with thickness. Value shown is $\sigma_{\bar{R}}/\sqrt{n}$.

TABLE XXXV

STATISTICAL ANALYSES OF RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND FLATWISE BEARING PROPERTIES OF STRESS-RELIEVED STRETCHED 7079-T651 PLATE

Ratio Cell	TUS (L) / TUS (LT)	TUS (ST) / TUS (LT)	TYS (L) / TYS (LT)	TYS (ST) / TYS (LT)	CYS (L) / TYS (LT)	CYS (LT) / TYS (LT)	CYS (ST) / TYS (LT)
1.13						1	2
1.08						1	1
1.05			3				1
1.04	2		2				
1.03	2		2				
1.02	2		1		1		
1.01	4				1		
1.00	2				4		
0.99	4	1		1	2		
0.98	2	1		2			
0.97	3	1		1			
0.96	1	1		1			
0.95	1	1					
0.94		1					
0.93		1					
0.92		1					
0.91		1					
0.90		1					
0.89							
0.88							
n	19	11	19	11	19	19	11
$\bar{R}$	0.988	0.939	1.025	0.925	0.995	1.058	1.043
σ_R	0.00447	0.00807	0.00733	0.00824	0.00332*	0.00162	0.00603
Min $\bar{R}$	0.979	0.922	1.017	0.907	0.973-0.996	1.055	1.030

Ratio Cell	SU (L) / TUS (LT)	SU (LT) / TUS (LT)	SU* (L+LT) / TUS (LT)
0.67	1		1
0.66	1	1	1
0.65	1	1	2
0.64	1	1	2
0.63	2	1	3
0.62	2	2	4
0.61	3	2	5
0.60	3	2	5
0.59	3	3	6
0.58	2	1	3
0.57	2	1	3
0.56	1	1	2
0.55		1	1
n	19	19	38
$\bar{R}$	0.606	0.599	0.603
σ_R	—	—	0.00332*
Min $\bar{R}$	—	—	0.576-0.640

e/D=1.5

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.73		1†	1†			
1.72	1†		1†			
1.71						
1.70						
1.69						
1.68						
1.67					1	
1.66				1		
1.65					1	1
1.64				1		
1.63						
1.62						
1.61						
1.60						
1.59						
1.58						
1.57						
1.56						
1.55						
1.54						
1.53						
1.52						
1.51						
1.50						
1.49						
1.48						
1.47						
1.46						
1.45						
1.44						
1.43						
1.42						
1.41						
1.40						
1.39						
1.38						
1.37						
1.36						
1.35						
1.34						
1.33						
1.32						
1.31						
1.30						
1.29						
1.28						
1.27						
1.26						
1.25						
1.24						
n	18	18	36	19	19	38
$\bar{R}$	1.566	1.588	1.577	1.564	1.579	1.571
σ_R	0.00921	0.00996	0.00695	—	—	0.00604*
Min $\bar{R}$	1.547	1.567	1.563	—	—	1.513-1.664

e/D=2.0

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)
2.14		1	1
2.13			
2.12			
2.11			
2.10			
2.09			
2.08	1		1
2.07			
2.06			
2.05			
2.04			
2.03			
2.02			
2.01			
2.00			
1.99			
1.98			
1.97			
1.96			
1.95			
1.94			
1.93			
1.92			
1.91			
1.90			
1.89			
1.88			
1.87			
1.86			
1.85			
1.84			
1.83			
1.82			
1.81			
1.80			
1.79			
1.78			
1.77			
1.76			
1.75			
1.74			
1.73			
1.72			
1.71			
1.70			
1.69			
1.68			
1.67	1		1
1.66			
1.65			
1.64		1	1
n	19	19	38
$\bar{R}$	1.981	1.991	1.989
σ_R	0.01261	0.01635	0.01028
Min $\bar{R}$	1.955	1.963	1.968

Ratio Cell	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.96		1	1
1.95			
1.94			
1.93	1		
1.92			
1.91			
1.90			
1.89			
1.88			
1.87			
1.86			
1.85			
1.84			
1.83			
1.82			
1.81			
1.80			
1.79			
1.78			
1.77			
1.76			
1.75			
1.74			
1.73			
1.72			
1.71			
1.70			
1.69			
1.68			
1.67	1		1
n	19	19	38
$\bar{R}$	1.808	1.835	1.822
σ_R	—	—	0.00819*
Min $\bar{R}$	—	—	1.787-1.892

* Student's "t"-test showed no significant difference between average ratios for L and LT directions.
† Omitted.
‡ Regression analysis showed significant relationship with thickness. Value shown is $\sigma_e / \sqrt{n}$.

TABLE XXXVI

STATISTICAL ANALYSES OF RATIOS AMONG TENSILE, COMPRESSIVE, SHEAR AND FLATWISE BEARING PROPERTIES OF STRESS-RELIEVED STRETCHED 7178-T651 PLATE

Ratio Cell	TUS (L) / TUS (LT)	TYS (L) / TYS (LT)	CYS (L) / CYS (LT)	CYS (LT) / TYS (LT)
1.12				1
1.11				1
1.10				1
1.08				1
1.07				1
1.06		2		1
1.05		1	1	4
1.04		2	2	
1.03		1	1	
1.02	1	2	3	
1.01	4	1	3	
1.00	2	2	2	
0.99	7			
0.98	2			
0.97	1			
n	17	17	17	17
$\bar{R}$	0.995	1.036	1.013	1.070
$\sigma_{\bar{R}}$	0.00315	0.00413*	0.00594	0.00568*
Min $\bar{R}$	0.988	0.983-1.032	1.000	1.012-1.066

Ratio Cell	SU (L) / TUS (LT)	SU (LT) / TUS (LT)	SU* (L+LT) / TUS (LT)
0.62	1	1	2
0.61	1	1	2
0.60	1	2	1
0.59	2	3	5
0.58	2	1	3
0.57	1	3	4
0.56	1	1	2
0.55	1	4	5
0.54	1	1	3
0.53	1	1	3
0.52	1		2
0.51		1	1
n	17	17	34
$\bar{R}$	0.574	0.566	0.570
$\sigma_{\bar{R}}$	—	—	0.00260*
Min $\bar{R}$	—	—	0.472-0.578

e/D=1.5

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.63				1	1	2
1.62				1	1	2
1.61				1	2	1
1.60				1	1	2
1.58				2	1	3
1.57	1	1	2	1	2	3
1.56	2	1	3	2	1	3
1.55	1	2	3	1	2	3
1.54	2	1	3	1	1	2
1.53	1	2	3	1	2	3
1.52	1	1	2	1	1	2
1.51	1	2	3	1	1	2
1.50	1	1	2	1	1	2
1.49	1	1	2	1	1	2
1.48	1	1	2	1	1	2
1.47	3	1	4	1	1	2
1.46	2	1	3	1	1	2
1.45	1	1	2	1	1	2
1.44	1	1	2	1	1	2
1.43	1	1	2	1	1	2
1.42	1	1	2	1	1	2
1.41	1	1	2	1	1	2
1.40	1	1	2	1	1	2
n	17	17	34	17	17	34
$\bar{R}$	1.508	1.515	1.511	1.505	1.505	1.505
$\sigma_{\bar{R}}$	—	—	0.00363*	—	—	0.00806*
Min $\bar{R}$	—	—	1.330-1.528	—	—	1.312-1.513

e/D=2.0

Ratio Cell	BUS (L) / TUS (LT)	BUS (LT) / TUS (LT)	BUS* (L+LT) / TUS (LT)
2.00	1		1
1.99		2	2
1.98	1	1	2
1.97	2	1	3
1.95	1		1
1.94	2		2
1.93	1		1
1.92	1		1
1.91	1	1	2
1.90	1	1	2
1.89	1		1
1.88	1		1
1.87	1	2	3
1.86	1	1	2
1.85	1	1	2
1.84	1	1	2
1.83	1	2	3
1.82	1	1	2
1.81	1	1	2
1.80	1	1	2
1.79	1	1	2
1.78	1		1
1.77	1		1
1.76	1		1
1.75	1		1
1.74	1	1	2
1.73		1	1
1.72		2	2
n	17	17	34
$\bar{R}$	1.879	1.855	1.867
$\sigma_{\bar{R}}$	—	—	0.00980*
Min $\bar{R}$	—	—	1.609-1.878

Ratio Cell	BYS (L) / TYS (LT)	BYS (LT) / TYS (LT)	BYS* (L+LT) / TYS (LT)
1.94		1	1
1.93		1	1
1.92	1	1	2
1.91	1	2	3
1.90	1	1	2
1.89	2	1	3
1.88	1	1	2
1.87	1	1	2
1.86	1	1	2
1.85	1	1	2
1.84	1	1	2
1.83	1	1	2
1.82	1	1	2
1.81	1	1	2
1.80	1	1	2
1.79	1	1	2
1.78	1	1	2
1.77	1	2	3
1.76	1	1	2
1.75	1	2	3
1.74	1	2	3
1.73	1	2	3
1.72	1	2	3
1.71	1	2	3
1.70	1	2	3
1.69	2	2	4
1.68	1	3	4
n	17	17	34
$\bar{R}$	1.769	1.788	1.779
$\sigma_{\bar{R}}$	—	—	0.01100*
Min $\bar{R}$	—	—	1.554-1.784

* Student's "t"-test showed no significant differences between average ratios for L and LT directions.
\# Regression analysis showed significant relationship with thickness. Value shown is $\sigma_{\bar{R}} / \sqrt{n}$ ..

TABLE XXXVII

RATIOS FOR COMPUTING DESIGN MECHANICAL PROPERTIES
OF STRESS-RELIEVED STRETCHED 2014-T651 PLATE

Ratio	Thickness, in.					
	0.250-0.499	0.500-1.000	1.001-1.500	1.501-2.000	2.001-3.000	3.001-4.000
$F_{tu}(L)/F_{tu}(LT)$	0.981	0.986	0.990	0.995	1.002	1.011
$F_{ty}(L)/F_{ty}(LT)$	1.023	1.023	1.023	1.023	1.023	1.023
$F_{cy}(L)/F_{ty}(LT)$	0.987	0.987	0.987	0.987	0.987	0.987
$F_{cy}(LT)/F_{ty}(LT)$	1.038	1.038	1.038	1.038	1.038	1.038
$F_{su}/F_{tu}(LT)$	0.602	0.602	0.602	0.602	0.602	0.602
$F_{bru}/F_{tu}(LT)$						
e/D=1.5	1.577	1.577	1.577	1.577	1.577	1.577
e/D=2.0	2.009	2.009	2.009	2.009	2.009	2.009
$F_{bry}/F_{ty}(LT)$						
e/D=1.5	1.533	1.533	1.533	1.533	1.533	1.533
e/D=2.0	1.811	1.811	1.811	1.811	1.811	1.811

TABLE XXXVIII

RATIOS FOR COMPUTING DESIGN MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T351 PLATE

Ratio	Thickness, in. 0.250-0.499	0.500-1.000	1.001-1.500	1.501-2.000	2.001-3.000	3.001-4.000
$F_{tu}(L)/F_{tu}(LT)$	1.008	1.008	1.008	1.008	1.008	1.008
$F_{ty}(L)/F_{ty}(LT)$	1.148	1.141	1.134	1.126	1.114	1.100
$F_{cy}(L)/F_{ty}(LT)$	0.946	0.936	0.927	0.918	0.903	0.884
$F_{cy}(LT)/F_{ty}(LT)$	1.075	1.068	1.062	1.056	1.047	1.035
$F_{su}/F_{tu}(LT)$	0.600	0.600	0.600	0.600	0.600	0.600
$F_{bru}/F_{tu}(LT)$						
e/D=1.5	1.514	1.514	1.514	1.514	1.514	1.514
e/D=2.0	1.854	1.854	1.854	1.854	1.854	1.854
$F_{bry}/F_{ty}(LT)$						
e/D=1.5	1.733	1.733	1.733	1.733	1.733	1.733
e/D=2.0	2.075	2.075	2.075	2.075	2.075	2.075

TABLE XXXIX

RATIOS FOR COMPUTING DESIGN MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 2024-T851 PLATE

Ratio	Thickness, in. 0.250-0.499	Thickness, in. 0.500-1.000
$F_{tu}(L)/F_{tu}(LT)$	1.001	1.001
$F_{ty}(L)/F_{ty}(LT)$	1.010	1.010
$F_{cy}(L)/F_{ty}(LT)$	1.013	1.001
$F_{cy}(LT)/F_{ty}(LT)$	1.018	1.013
$F_{su}/F_{tu}(LT)$	0.572	0.572
$F_{bru}/F_{tu}(LT)$		
e/D=1.5	1.527	1.527
e/D=2.0	1.948	1.948
$F_{bry}/F_{ty}(LT)$		
e/D=1.5	1.502	1.502
e/D=2.0	1.756	1.756

TABLE XL

RATIOS FOR COMPUTING DESIGN MECHANICAL PROPERTIES
OF STRESS-RELIEVED STRETCHED 7075-T651 PLATE

Ratio	Thickness, in. 0.250-0.499	0.500-1.000	1.001-2.000	2.001-2.500	2.501-3.000	3.001-3.500	3.501-4.000
$F_{tu}(L)/F_{tu}(LT)$	0.988	0.988	0.988	0.988	0.988	0.988	0.988
$F_{tu}(ST)/F_{tu}(LT)$	---	---	---	0.896	0.896	0.896	0.896
$F_{ty}(L)/F_{ty}(LT)$	1.032	1.032	1.032	1.032	1.032	1.032	1.032
$F_{ty}(ST)/F_{ty}(LT)$	---	---	---	0.890	0.890	0.890	0.890
$F_{cy}(L)/F_{ty}(LT)$	1.008	0.999	0.987	0.974	0.966	0.957	0.949
$F_{cy}(LT)/F_{ty}(LT)$	1.059	1.059	1.059	1.059	1.059	1.059	1.059
$F_{cy}(ST)/F_{ty}(LT)$	---	---	---	1.021	1.021	1.021	1.021
$F_{su}/F_{tu}(LT)$	0.562	0.568	0.579	0.591	0.598	0.606	0.614
$F_{bru}/F_{tu}(LT)$							
e/D=1.5	1.516	1.516	1.516	1.516	1.516	1.516	1.516
e/D=2.0	1.869	1.869	1.869	1.869	1.869	1.869	1.869
$F_{bry}/F_{ty}(LT)$							
e/D=1.5	1.468	1.485	1.517	1.550	1.572	1.594	1.616
e/D=2.0	1.723	1.740	1.773	1.807	1.829	1.852	1.874

TABLE XLI

RATIOS FOR COMPUTING DESIGN MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 7079-T651 PLATE

Ratio	Thickness, in. 0.250-1.500	1.501-2.000	2.001-2.500	2.501-3.000	3.001-4.000	4.001-4.500	4.501-5.000	5.001-5.500	5.501-6.000
$F_{tu}(L)/F_{tu}(LT)$	0.979	0.979	0.979	0.979	0.979	0.979	0.979	0.979	0.979
$F_{tu}(ST)/F_{tu}(LT)$	---	---	0.921	0.921	0.921	0.921	0.921	0.921	0.921
$F_{ty}(L)/F_{ty}(LT)$	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017	1.017
$F_{ty}(ST)/F_{ty}(LT)$	---	---	0.907	0.907	0.907	0.907	0.907	0.907	0.907
$F_{cy}(L)/F_{ty}(LT)$	0.996	0.991	0.989	0.987	0.983	0.978	0.977	0.975	0.973
$F_{cy}(LT)/F_{ty}(LT)$	1.055	1.055	1.055	1.055	1.055	1.055	1.055	1.055	1.055
$F_{cy}(ST)/F_{ty}(LT)$	---	---	1.030	1.030	1.030	1.030	1.030	1.030	1.030
$F_{su}/F_{tu}(LT)$	0.576	0.588	0.594	0.601	0.611	0.621	0.627	0.634	0.640
$F_{bru}/F_{tu}(LT)$									
e/D=1.5	1.563	1.563	1.563	1.563	1.563	1.563	1.563	1.563	1.563
e/D=2.0	1.968	1.968	1.968	1.968	1.968	1.968	1.968	1.968	1.968
$F_{bry}/F_{ty}(LT)$									
e/D=1.5	1.513	1.540	1.556	1.571	1.594	1.617	1.633	1.648	1.664
e/D=2.0	1.767	1.789	1.802	1.815	1.834	1.853	1.866	1.879	1.892

TABLE XLII

RATIOS FOR COMPUTING DESIGN MECHANICAL PROPERTIES OF STRESS-RELIEVED STRETCHED 7178-T651 PLATE

Ratio	Thickness, in.			
	0.250-0.499	0.500-1.000	1.001-1.500	1.501-2.000
$F_{tu}(L)/F_{tu}(LT)$	0.988	0.988	0.988	0.988
$F_{ty}(L)/F_{ty}(LT)$	1.032	1.019	1.001	0.983
$F_{cy}(L)/F_{ty}(LT)$	1.000	1.000	1.000	1.000
$F_{cy}(LT)/F_{ty}(LT)$	1.066	1.048	1.024	1.012
$F_{su}/F_{tu}(LT)$	0.578	0.549	0.510	0.472
$F_{bru}/F_{tu}(LT)$				
e/D=1.5	1.528	1.474	1.402	1.330
e/D=2.0	1.878	1.805	1.707	1.609
$F_{bry}/F_{ty}(LT)$				
e/D=1.5	1.513	1.458	1.385	1.312
e/D=2.0	1.784	1.721	1.638	1.554

TABLE XLIII

DESIGN MECHANICAL PROPERTIES OF 2014-T651 ALUMINUM ALLOY PLATE

ALLOY	2014											
FORM	Plate											
CONDITION	-T651											
THICKNESS, in.	0.250-0.499		0.500-1.000		1.001-1.500		1.501-2.000		2.001-3.000		3.001-4.000[a]	
BASIS	A	B	A	B	A	B	A	B	A	B	A	B
Mechanical Properties:												
F_{tu}, ksi												
L	66[b]	68[b]	66[b]	68[b]	66[b]	67[b]	65	66[c]	63	64[c]	60[de]	61[ce]
LT	67	69	67	69	67	68	65	66[c]	63	64[c]	59	60[c]
ST	--	--	--	--	--	--	--	--	58	59[c]	54	55[c]
F_{ty}, ksi												
L	60	62	60	62	60[d]	62[b]	60[d]	62[c]	58[d]	60[c]	56[de]	58[ce]
LT	59	61	59	61	59	61[b]	59	61[c]	57	59[c]	55	57[c]
ST	--	--	--	--	--	--	--	--	53	55[c]	51	53[c]
F_{cy}, ksi												
L	58[b]	60[b]	58[b]	60[b]	58[b]	60[b]	58[b]	60[c]	56[b]	58[c]	54[be]	56[ce]
LT	61	63	61	63	61	63	61	63[c]	59	61[c]	57[e]	59[ce]
ST	--	--	--	--	--	--	--	--	59	61[c]	57	59[ce]
F_{su}, ksi	40[b]	41[b]	40[b]	41[b]	40[b]	41	39[b]	40[c]	38[b]	39[c]	36[be]	36[ce]
F_{bru}, ksi[f]												
(e/D=1.5)	106[d]	109[d]	106[d]	109[d]	106[d]	107[d]	103[d]	104[c]	99[d]	101[c]	92[de]	95[ce]
(e/D=2.0)	135[d]	139[d]	135[d]	139[d]	135[d]	137[d]	131[d]	133[c]	127[b]	129[c]	119[de]	121[ce]
F_{bry}, ksi[f]												
(e/D=1.5)	90[d]	93[d]	90[d]	93[d]	90[d]	93[d]	90[d]	93[c]	87[d]	90[c]	84[de]	87[ce]
(e/D=2.0)	107[d]	110[d]	107[d]	110[d]	107[d]	110[d]	107[d]	110[c]	103[d]	107[c]	100[de]	103[ce]
e, per cent												
L	7[b]	--	6	--	6	--	6	--	4	--	3[b]	--
LT	7[b]	--	6	--	4	--	3	--	2	--	1[b]	--
ST	--	--	--	--	--	--	--	--	1	--	--	--
E, 10^6 psi	10.7[g]											
E_c, 10^6 psi	10.9[g]											
G, 10^6 psi	4.05[g]											

a - Not covered by specifications.
b - Lower than for T6 in MIL-HDBK-5, August 1962.
c - New value; not shown in MIL-HDBK-5, August 1962.
d - Higher than for T6 in MIL-HDBK-5, August 1962.
e - Computed using extrapolation.
f - Bearing tests made using ultrasonic cleaning; results average higher than without cleaning.
g - Higher than in MIL-HDBK-5, August 1962.

TABLE XLIV

DESIGN MECHANICAL PROPERTIES OF 2024-T351 AND -T851 ALUMINUM ALLOY PLATE

ALLOY	2024														
FORM	Plate														
CONDITION	-T351												-T851[c]		
THICKNESS, in.	0.250-0.499		0.500-1.000		1.001-1.500		1.501-2.000		2.001-3.000		3.001-4.000[a]		0.250-0.499		0.500-1.050
BASIS	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A
Mechanical Properties:															
F_{tu}, ksi															
L	65	67	62[b]	64[b]	62[d]	64[d]	61[d]	63[b]	60[c]	62[c]	56[ce]	58[ce]	67[c]	68[c]	66[c]
LT	64	66	62[b]	64[b]	62[d]	64[d]	61[d]	63	60[d]	62[d]	56[c]	58[c]	67[c]	68[c]	66[c]
F_{ty}, ksi															
L	46	49	47[d]	50[d]	46[d]	49[d]	46[d]	49[d]	46[c]	49[c]	44[ce]	46[ce]	59[c]	61[c]	59[c]
LT	40	43	41[d]	44	41[d]	44	41[d]	44	41[d]	44	40[c]	42[c]	58[c]	60[c]	58[c]
F_{cy}, ksi															
L	38	41	38	41[b]	38	41[b]	38	41[b]	37[c]	40[c]	35[ce]	37[ce]	59[c]	61[c]	58[c]
LT	43	46	44[c]	47	44[d]	47[d]	43[c]	46	43[c]	46[c]	41[ce]	43[ce]	59[c]	61[c]	59[c]
F_{su}, ksi	38[b]	40[b]	37[b]	38[b]	37[d]	39	37[d]	38	36[c]	37[c]	34[ce]	35[ce]	38[c]	39[c]	38[c]
F_{bru}, ksi[f]															
(e/D=1.5)	97[b]	100[b]	94[b]	97[b]	94[d]	97[d]	92	95[b]	91[c]	94[c]	85[ce]	88[ce]	142[c]	104[c]	101[c]
(e/D=2.0)	119[b]	122[b]	115[b]	119[b]	115[b]	119[b]	113[b]	117[b]	111[c]	115[c]	104[ce]	108[ce]	131[c]	132[c]	129[c]
F_{bry}, ksi[f]															
(e/D=1.5)	69[d]	74[d]	71[d]	76[d]	71[d]	76[d]	71[d]	76[d]	71[c]	76[c]	69[ce]	73[ce]	87[c]	90[c]	87[c]
(e/D=2.0)	83[d]	89[d]	85[d]	91[d]	85[d]	91[d]	85[d]	91[d]	85[c]	91[c]	83[ce]	87[ce]	102[c]	105[c]	102[c]
e_{LT} per cent	12	—	8	—	7	—	6	—	4	—	4[c]	—	5[c]	—	5[c]
E, 10^6 psi	10.7[g]														
E_c, 10^6 psi	10.9[g]														
G, 10^6 psi	4.05[g]														

a - Not covered by specifications.
b - Lower than for T4 in MIL-HDBK-5, August 1962.
c - New value; not shown in MIL-HDBK-5, August 1962.
d - Higher than for T4 in MIL-HDBK-5, August 1962.
e - Computed using extrapolation.
f - Bearing tests made using ultrasonic cleaning; results average higher than without cleaning.
g - Higher than in MIL-HDBK-5, August 1962.

TABLE XLV

DESIGN MECHANICAL PROPERTIES OF 7075-T651 ALUMINUM ALLOY PLATE

ALLOY	7075													
FORM	Plate													
CONDITION	-T651													
THICKNESS, in.	0.250-0.499		0.500-1.000		1.001-2.000		2.001-2.500		2.501-3.000		3.001-3.500[a]		3.501-4.000[a]	
BASIS	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Mechanical Properties:														
F_{tu}, ksi														
L	76[b]	78[b]	76[b]	79[b]	76[b]	78[b]	72[b]	74[b]	69[b]	71[b]	69[d]	71[c]	66	68[c]
LT	77	79	77	80	77	79	73	75	70	72	70[d]	72[c]	67[d]	69[c]
ST	—	—	—	—	—	—	65[b]	67[b]	63[b]	65[b]	63[b]	65[c]	60[b]	62[c]
F_{ty}, ksi														
L	68[d]	70[d]	68[b]	71[b]	68	71	64[d]	67[d]	62[d]	64[d]	59[d]	61[c]	55[b]	57[c]
LT	66	68	66	69	66	69	62	65	60	62	57[b]	59[c]	53[b]	55[c]
ST	—	—	—	—	—	—	55[b]	58[b]	53[b]	55[b]	51[b]	53[c]	47[b]	49[c]
F_{cy}, ksi														
L	67[d]	69[d]	66[d]	69[d]	65[b]	68[b]	60[b]	63[b]	58[b]	60[b]	55[c]	57[c]	50[c]	52[c]
LT	70[d]	72[d]	70[d]	73[d]	70[d]	73[d]	66[d]	69[d]	64[d]	66[d]	60[b]	62[c]	56[b]	58[c]
ST	—	—	—	—	—	—	63[b]	66	61[b]	63	58[b]	60[c]	54[b]	56[c]
F_{su}, ksi	43[b]	44[b]	44[b]	45[b]	45[b]	46[b]	43	44[b]	42[d]	43	42[d]	44[c]	41[d]	42[c]
F_{bru}, ksi[e]														
(e/D=1.5)	117[d]	120[d]	117[d]	121[d]	117[d]	120[d]	111[d]	114[d]	106[d]	109[d]	106[d]	109[c]	102[d]	105[c]
(e/D=2.0)	144[d]	148[d]	144[d]	150[d]	144[d]	148[d]	136[d]	140[d]	131[d]	135[d]	131[d]	135[c]	125[d]	129[c]
F_{bry}, ksi[e]														
(e/D=1.5)	97[d]	100[d]	98[d]	102[d]	100[d]	105[d]	96[d]	101[d]	94[d]	97[d]	91[d]	94[c]	86[d]	89[c]
(e/D=2.0)	114[d]	117[d]	115[d]	120[d]	117[d]	122[d]	112[d]	117[d]	110[d]	113[d]	106[d]	109[c]	99[d]	103[c]
e, per cent														
L	8	—	6	—	5	—	5	—	5	—	5	—	—	—
LT	8	—	6	—	4	—	3	—	3	—	3	—	2	—
ST	—	—	—	—	—	—	1	—	1	—	1	—	—	—
E, 10^6 psi	10.3													
E_c, 10^6 psi	10.6[f]													
G, 10^6 psi	3.9													

a - Not covered by specifications.
b - Lower than for T6 in MIL-HDBK-5, August 1962.
c - New value; not shown in MIL-HDBK-5, August 1962.
d - Higher than for T6 in MIL-HDBK-5, August 1962.
e - Bearing tests made using ultrasonic cleaning; results average higher than without cleaning.
f - Higher than in MIL-HDBK-5, August 1962.

TABLE XLVI

DESIGN MECHANICAL PROPERTIES OF 7079-T651 ALUMINUM ALLOY PLATE

ALLOY	7079																	
CONDITION	Plate																	
THICKNESS, in.	0.250-1.500		1.501-2.000		2.001-2.500		2.501-3.000		3.001-4.000		4.001-4.500		4.501-5.000		5.001-5.500		5.501-6.000	
BASIS	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Mechanical Properties:																		
F_{tu}, ksi																		
L	71[a]	72[c]	71[a]	72[c]	71[a]	72[c]	70[b]	71[c]	70[d]	71[c]	68[d]	69[c]	68[d]	69[c]	67[d]	68[c]	66[d]	67[c]
LT	73[a]	74[c]	73	74[c]	72[b]	74[c]	72[b]	73[c]	69[bd]	72[c]	68[b]	70[c]	68[b]	70[c]	67[b]	69[c]	67[b]	69[c]
ST	—	—	—	—	68[b]	69[c]	68[b]	69[c]	65[bd]	68[c]	64[b]	66[c]	64[b]	66[c]	63[b]	65[c]	63[b]	65[c]
F_{ty}, ksi																		
L	63[a]	65[c]	63[a]	65[c]	64[b]	65[c]	63[b]	64[c]	60[d]	61[c]	58[d]	59[c]	58[d]	59[c]	57[d]	58[c]	56[d]	57[c]
LT	63[a]	64[c]	63[a]	64[c]	63[b]	64[c]	63[b]	64[c]	60[bd]	61[c]	58[d]	59[c]	58[d]	59[c]	57[d]	58[c]	56[d]	57[c]
ST	—	—	—	—	59[b]	60[c]	58[b]	59[c]	56[bd]	57[c]	54[d]	55[c]	54[d]	55[c]	53[d]	54[c]	52[d]	53[c]
F_{cy}, ksi																		
L	63[a]	64[c]	63[a]	63[c]	63[b]	63[c]	62[a]	63[c]	59[a]	60[c]	57[a]	58[c]	57[a]	58[c]	56[a]	57[c]	54[a]	55[c]
LT	65[a]	66[c]	65[a]	67[c]	65[b]	66[c]	64[a]	65[c]	60[b]	63[c]	60[b]	62[c]	60[b]	62[c]	59	60[c]	58	59[c]
ST	—	—	—	—	66[b]	67[c]	65[b]	66[c]	62[b]	64[c]	61[b]	62[c]	61[b]	62[c]	59	60[c]	58	59[c]
F_{su}, ksi	42[a]	43[c]	43[a]	44[c]	43[a]	44[c]	43[b]	43[c]	43[b]	43[c]	42[b]	43[c]	42[b]	43[c]	42[b]	43[c]	42[b]	43[c]
F_{bru}, ksi[e]																		
(e/D=1.5)	114[b]	116[c]	114[b]	116[c]	114[b]	116[c]	111[b]	113[c]	109[b]	111[c]	106[b]	108[c]	106[b]	108[c]	105[b]	107[c]	103[b]	105[c]
(e/D=2.0)	144[b]	146[c]	144[b]	146[c]	144[b]	146[c]	140[b]	142[c]	138[b]	140[c]	134[b]	136[c]	134[b]	136[c]	132[b]	134[c]	130[b]	132[c]
F_{bry}, ksi[e]																		
(e/D=1.5)	96[b]	97[c]	97[b]	99[c]	98[b]	100[c]	97[b]	99[c]	96[b]	97[c]	94[b]	95[c]	94[b]	96[c]	94[b]	96[c]	93[b]	95[c]
(e/D=2.0)	211[b]	213[c]	213[b]	214[c]	214[b]	215[c]	213[b]	214[c]	210[b]	212[c]	207[b]	209[c]	207[b]	210[c]	207[b]	209[c]	206[b]	208[c]
e, per cent																		
L	—	—	—	—	6	—	6	—	6	—	6	—	5	—	4	—	4	—
LT	8	—	7	—	6	—	6	—	5	—	5	—	5	—	4	—	4	—
ST	—	—	—	—	2	—	2	—	2	—	2	—	2	—	2	—	2	—
E, 10^6 psi	10.3																	
E_c, 10^6 psi	10.6[b]																	
G, 10^6 psi	3.9																	

a - Lower than T6, T651 in MIL-HDBK-5, August 1962.
b - Higher than T6, T651 in MIL-HDBK-5, August 1962.
c - Rev value; not shown in MIL-HDBK-5, August 1962.
d - Higher than indicated using ratios to LT properties from tests in this report.
e - Bearing tests made using ultrasonic cleaning; results average higher than without cleaning.

TABLE XLVII

DESIGN MECHANICAL PROPERTIES OF 7178-T651 ALUMINUM ALLOY PLATE

ALLOY	7178							
FORM	Plate							
CONDITION	-T651							
THICKNESS, in.	0.250-0.499		0.500-1.000		1.001-1.500		1.501-2.000	
BASIS	A	B	A	B	A	B	A	B
Mechanical Properties:								
F_{tu}, ksi								
L	83[a]	85[a]	83[a]	85[a]	83[a]	85[c]	79[ad]	80[cd]
LT	84	86	84	86	84	86[c]	80	81[c]
F_{ty}, ksi								
L	75[b]	77[b]	74[b]	76[a]	73[a]	75[c]	70[cd]	71[cd]
LT	73	75	73	75	73	75[c]	70	71[c]
F_{cy}, ksi								
L	73[a]	75[a]	73[a]	75[a]	73[a]	75[c]	70[cd]	71[cd]
LT	78[b]	80[b]	77[b]	79[b]	75[a]	77[c]	71[cd]	72[cd]
F_{su}, ksi	49[a]	50[a]	46[a]	47[a]	43[a]	44[c]	38[cd]	38[cd]
F_{bru}, ksi[e]								
(e/D=1.5)	128[b]	131[b]	124[b]	127[b]	118	121[c]	106[cd]	108[cd]
(e/D=2.0)	158[b]	161[b]	152[b]	155	143[a]	147[c]	129[cd]	130[cd]
F_{bry}, ksi[e]								
(e/D=1.5)	110[b]	113[b]	106[b]	109[b]	101[b]	104[c]	92[cd]	93[cd]
(e/D=2.0)	130[b]	133[b]	126[b]	129[b]	119[b]	123[c]	109[cd]	110[cd]
e, per cent LT	8	--	6	--	4	--	3	--
E, 10^6 psi	10.3							
E_c, 10^6 psi	10.6[f]							
G, 10^6 psi	3.9							

a - Lower than for T6 in MIL-HDBK-5, August 1962.
b - Higher than for T6 in MIL-HDBK-5, August 1962.
c - New value; not shown in MIL-HDBK-5, August 1962.
d - Computed using extrapolation.
e - Bearing tests made using ultrasonic cleaning; results average higher than without cleaning.
f - Higher than in MIL-HDBK-5, August 1962.

TABLE XLVIII

RATIOS OF TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES AT CENTER OF THICKNESS TO THOSE AT MIDWAY LOCATION FOR STRESS-RELIEVED STRETCHED PLATE OF SEVERAL ALUMINUM ALLOYS

Alloy and Temper	Sample: Thickness, in.	Sample: Number and Producer	Direction*	Properties at Center/Properties at Midway: $\frac{TUS(C)}{TUS(M)}$	$\frac{TYS(C)}{TYS(M)}$	$\frac{CYS(C)}{CYS(M)}$	$\frac{SU(C)}{SU(M)}$	$\frac{BUS(C)}{BUS(M)}$ § e/D= 1.5	$\frac{BUS(C)}{BUS(M)}$ § e/D= 2.0	$\frac{BYS(C)}{BYS(M)}$ § e/D= 1.5	$\frac{BYS(C)}{BYS(M)}$ § e/D= 2.0
2014-T651	1.501	301652	L	0.99	0.98	1.00	0.91	0.94	0.95	0.93	0.94
			LT	1.00	1.00	0.99	0.90	0.96	0.95	0.95	0.95
	1.891	281486	L	0.99	0.97	0.99	0.95	0.97	0.97	0.98	0.98
			LT	1.00	1.00	0.98	0.94	0.99	0.93	0.97	0.97
	2.000	281656‡‡	L	1.02	1.02	1.03	0.94	0.97	0.97	0.96	0.97
			LT	0.99	1.00	1.00	0.94	0.97	0.95	0.97	0.98
	2.001	281580	L	1.01	0.99	1.01	0.91	0.96	0.96	0.96	0.95
			LT	0.98	0.98	0.97	0.91	0.95	0.96	0.95	0.96
	2.250	281655‡‡	L	1.03	1.03	1.03	0.95	0.96	0.97	0.97	1.00
			LT	0.98	0.98	0.99	0.94	0.95	0.95	0.93	0.96
	2.500	281597	L	1.01	0.99	1.03	0.92	0.95	0.95	0.94	0.95
			LT	1.00	1.00	1.02	0.90	0.96	0.95	0.96	0.96
2024-T351	1.980	301845	L	1.02	1.04	1.08	0.92	0.96	0.97	0.96	0.97
			LT	1.04	1.07	1.03	0.92	0.96	0.95	0.96	0.94
	2.000	301819	L	1.02	1.02	1.06	0.90	0.97	0.99	0.97	1.01
			LT	1.03	1.05	1.04	0.91	0.97	0.99	0.93	0.98
	2.000	281844‡‡	L	1.05	1.03	1.08	0.89	0.96	0.96	0.97	0.98
			LT	1.03	1.03	1.04	0.93	0.99	0.99	0.97	0.98
	2.001	281581	L	1.01	1.03	1.07	0.93	0.99	1.01	0.99	0.99
			LT	1.00	1.04	1.05	0.92	0.96	0.97	0.95	0.94
	2.250	281598	L	1.04	1.03	1.04	0.95	0.97	1.01	1.00	1.00
			LT	0.99	1.03	1.02	0.91	0.94	0.96	0.92	0.96
	2.250	301782‡	L	1.09	1.09	1.11	0.92	0.97	0.95	0.97	0.97
			LT	1.06	1.09	1.05	0.89	0.94	0.96	0.96	0.97
	2.515	281749	L	1.08	1.04	1.08	0.92	0.93	0.98	0.96	1.05
			LT	1.03	1.03	0.99	0.96	1.00	1.00	1.03	1.03
	2.800	301848	L	1.09	1.09	1.13	0.93	1.01	0.97	1.01	1.02
			LT	1.03	1.03	1.06	0.94	0.99	0.99	1.00	1.01
	3.000	301846	L	0.99	1.00	1.08	0.90	0.95	0.97	0.96	0.97
			LT	1.03	1.05	1.04	0.88	0.98	1.00	0.94	0.97
2024-T851	2.001	281590	L	0.98	0.98	1.01	0.96	0.95	0.94	0.96	0.95
			LT	0.98	0.98	0.99	0.94	0.99	0.98	0.99	0.98
	2.250	281615	L	0.98	0.96	1.00	0.94	0.95	0.95	0.94	0.95
			LT	0.97	0.98	0.97	0.94	0.94	0.97	0.94	0.98
	2.250	301783	L	1.00	0.99	1.03	0.95	0.98	0.97	0.98	0.97
			LT	1.00	1.00	1.01	0.96	0.98	0.97	0.99	0.98
	2.515	281750	L	1.00	0.98	1.05	0.96	0.96	0.98	0.97	0.98
			LT	1.00	1.01	1.00	0.97	0.98	0.99	0.96	1.01

—CONCLUDED ON NEXT PAGE—

TABLE XLVIII (CONCLUDED)

RATIOS OF TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES AT CENTER OF THICKNESS TO THOSE AT MIDWAY LOCATION FOR STRESS-RELIEVED STRETCHED PLATE OF SEVERAL ALUMINUM ALLOYS

Alloy and Temper	Sample: Thickness, in.	Sample: Number and Producer	Sample: Direction*	Properties at Center/Properties at Midway: TUS(C)/TUS(M)	TYS(C)/TYS(M)	CYS(C)/CYS(M)	SU(C)/SU(M)	BUS(C)/BUS(M) § e/D=1.5	BUS(C)/BUS(M) § e/D=2.0	BYS(C)/BYS(M) § e/D=1.5	BYS(C)/BYS(M) § e/D=2.0
7075-T651	1.625	281385	L	1.05	1.04	1.05	0.89	0.94	0.95	0.97	0.98
			LT	1.04	1.06	1.04	0.91	0.96	0.95	0.94	0.99
	2.001	281502‡‡	L	1.05	1.04	1.03	0.95	1.00	0.99	1.03	0.99
			LT	1.00	1.01	1.01	0.97	0.96	0.97	0.97	0.98
	2.250	281417	L	1.07	1.05	1.06	0.94	0.92	0.97	0.96	0.98
			LT	0.99	0.98	1.01	0.93	0.98	0.96	0.98	0.98
	2.250	281654‡‡	L	1.03	1.04	1.07	0.94	0.98	1.00	0.99	0.98
			LT	1.06	1.07	1.02	0.93	1.00	1.00	0.99	0.99
	2.269	281411	L	1.06	1.04	1.04	0.93	0.97	0.98	0.97	1.02
			LT	1.05	1.06	1.02	0.95	0.96	0.99	0.96	1.02
	2.501	301894	L	1.11	1.07	1.11	0.95	1.00	1.01	0.98	0.99
			LT	1.04	1.03	1.07	0.92	0.99	0.98	0.99	1.01
	2.501	301897	L	1.08	1.06	1.13	0.91	1.00	0.98	0.97	0.99
			LT	1.01	1.03	1.08	0.90	0.99	1.00	0.97	0.98
	2.773	281491	L	1.05	1.04	1.06	0.95	0.98	0.97	0.98	0.98
			LT	1.01	1.02	1.02	0.94	0.97	0.94	0.96	0.97
	3.025	281420	L	1.05	1.05	1.09	0.96	0.97	0.98	0.99	0.98
			LT	1.04	1.05	1.02	0.91	0.99	0.98	0.99	0.98
	3.953	381684	L	1.06	1.07	1.08	0.98	0.98	1.01	1.01	0.99
			LT	0.99	1.01	1.02	0.95	1.01	1.01	0.99	1.00
7079-T651	1.635	281410	L	1.00	0.99	0.98	0.92	1.00	0.95	1.00	0.96
			LT	0.99	0.99	0.98	0.92	1.00	0.94	0.98	0.95
	2.000	281500‡‡	L	1.05	1.04	1.04	0.93	0.96	0.94	0.97	0.98
			LT	1.01	1.02	1.01	0.93	1.03	0.95	0.96	0.98
	2.260	301876	L	1.09	1.08	1.08	0.91	0.98	0.98	0.96	0.98
			LT	1.06	1.07	1.07	0.92	0.96	0.96	0.96	0.99
	2.500	301877	L	1.09	1.10	1.03	0.96	0.99	1.02	0.98	1.01
			LT	1.02	1.02	1.03	0.95	0.97	0.98	1.00	1.02
	3.000	281842‡‡	L	1.07	1.06	1.06	0.93	0.97	0.97	0.95	0.97
			LT	0.99	0.98	1.01	0.95	0.95	0.95	0.94	0.97
	3.000	281554	L	1.09	1.08	1.06	0.91	0.98	0.97	0.98	0.99
			LT	1.02	1.02	1.02	0.91	0.97	0.96	0.98	0.99
	3.001	281392	L	1.07	1.04	1.05	0.98	0.96	0.96	0.95	0.97
			LT	1.08	1.01	1.03	0.92	0.97	0.95	0.97	0.99
	3.277	281582	L	1.08	1.07	1.07	0.93	1.02	1.00	0.97	0.98
			LT	1.02	1.02	1.02	0.90	1.01	0.97	0.97	1.00
	4.001	281492	L	1.09	1.08	1.10	0.94	1.00	0.99	0.99	1.02
			LT	1.04	1.04	1.02	0.92	0.96	0.96	0.96	0.97
	4.499	281393	L	1.02	1.03	1.04	0.92	0.95	1.00	0.97	1.00
			LT	0.98	0.97	0.98	0.93	0.94	0.94	0.98	0.95
	4.770	301879	L	1.07	1.07	1.06	0.91	0.99	0.99	0.98	0.99
			LT	1.01	1.02	1.02	0.91	0.97	0.97	0.95	0.95
	6.000	301878	L	1.05	1.05	1.06	0.96	0.99	1.03	1.01	1.00
			LT	0.99	0.98	1.00	0.95	0.98	0.97	0.98	0.97

* L, longitudinal; LT, long transverse.
§ Flattened specimens.

‡ From Producer C.
‡‡ From Producer B.
All others from Producer A.

TABLE XLIX

RATIOS OF TENSILE, COMPRESSIVE, SHEAR AND BEARING PROPERTIES AT CENTER OF THICKNESS TO THOSE AT MIDWAY LOCATION FOR PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Direction*	Properties at Center/Properties at Midway: TUS(C)/TUS(M)	TYS(C)/TYS(M)	CYS(C)/CYS(M)	SU(C)/SU(M)	BUS(C)/BUS(M) ‡ e/D=1.5	BUS(C)/BUS(M) ‡ e/D=2.0	BYS(C)/BYS(M) ‡ e/D=1.5	BYS(C)/BYS(M) ‡ e/D=2.0
2014-T6	2.500	281547A	L	1.02	1.00	0.99	0.92	0.93	0.93	0.94	0.94
			LT	0.96	0.96	0.98	0.92	0.94	0.94	0.93	0.93
2024-T42	2.001	281372A	L	1.04	1.08	1.04	0.92	0.98	1.00	0.97	1.02
			LT	1.04	1.10	1.06	0.94	0.96	0.99	0.94	0.96
2024-T62	2.001	281372B	L	0.99	1.02	1.00	0.95	0.97	0.99	0.96	0.97
			LT	0.98	1.00	1.00	0.91	0.95	0.97	0.97	0.99
7075-T6	2.250	281380A	L	1.05	1.06	0.98	0.93	0.97	1.01	0.96	1.02
			LT	1.00	1.00	1.01	0.92	0.98	0.97	0.96	0.95
	2.501	281383A	L	1.05	1.04	1.02	0.93	0.97	0.98	0.96	0.98
			LT	0.98	0.98	1.00	0.94	0.96	0.96	0.96	0.98
	2.522	281418A	L	1.06	1.05	1.03	0.94	0.99	0.97	0.99	1.00
			LT	1.01	0.97	1.01	0.95	0.95	0.98	0.96	0.99
	3.001	281387A	L	1.06	1.07	1.05	0.94	0.97	0.97	0.99	0.97
			LT	1.04	1.05	1.03	0.93	1.01	1.00	0.99	1.03
7079-T6	1.625	281391A	L	1.00	1.01	1.00	0.94	0.97	0.97	0.95	0.96
			LT	1.00	1.02	1.00	0.92	0.97	0.96	0.95	0.97
	2.280	301858A	L	1.06	1.07	1.02	0.87	0.95	0.95	0.93	0.97
			LT	1.03	1.04	1.01	0.88	0.96	0.97	0.95	0.96
	2.500	301859A	L	1.05	1.04	1.01	0.93	0.97	0.97	0.96	0.97
			LT	1.01	1.01	1.00	0.92	0.97	0.96	0.95	0.96
	3.001	281423A	L	1.07	1.08	1.03	0.93	0.98	0.98	0.97	0.99
			LT	1.00	1.01	1.00	0.95	0.99	0.97	0.95	1.01
	4.000	301860A	L	1.08	1.12	1.12	0.91	0.98	0.96	0.96	0.98
			LT	1.05	1.05	1.04	0.94	0.99	0.96	0.99	0.98
	4.040	301850A	L	1.09	1.10	1.06	0.93	0.98	0.97	0.96	0.97
			LT	1.04	1.06	1.04	0.93	0.96	0.97	0.96	0.98
	4.800	301851A	L	1.08	1.09	1.05	0.93	0.97	0.96	0.96	0.93
			LT	1.03	1.05	1.03	0.93	0.95	0.95	0.94	0.95

* L, longitudinal; LT, long transverse.
† All samples received in the -O or -F temper from Producer A and heat treated to the "heat-treated-by-user" temper by Alcoa Research Laboratories.
‡ Flatwise specimens.

TABLE L

AVERAGE RATIOS AMONG PROPERTIES AT CENTER OF THICKNESS TO THOSE AT MIDWAY LOCATION IN ALUMINUM ALLOY PLATE

Alloy and Temper	Number of Samples	TUS		TYS		CYS		SS		BUS† e/D=1.5		BUS† e/D=2.0		BYS† e/D=1.5		BYS† e/D=2.0	
		L	LT	L	LT	L	LT	L	LT	L	LT	L	LT	L	LT	L	LT
2024-T351	9	1.04	1.03	1.04	1.05	1.08	1.04	0.92	0.92	0.97	0.97	0.98	0.98	0.98	0.96	1.00	0.98
2024-T42	1	1.04	1.04	1.08	1.10	1.04	1.06	0.92	0.94	0.96	0.96	1.00	0.99	0.97	0.94	1.02	0.96
2014-T651	6	1.01	0.99	1.00	0.99	1.02	0.99	0.93	0.92	0.96	0.96	0.96	0.95	0.96	0.96	0.96	0.96
2024-T851	4	0.99	0.99	0.98	0.99	1.02	0.99	0.95	0.95	0.96	0.97	0.96	0.98	0.96	0.97	0.96	0.99
	AVG.‡	1.00	0.99	0.99	0.99	1.02	0.99	0.94	0.93	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.97
7075-T651	10	1.06	1.02	1.05	1.04	1.07	1.02	0.94	0.93	0.97	0.98	0.98	0.98	0.98	0.97	0.98	0.99
7079-T651	12	1.06	1.02	1.06	1.01	1.05	1.02	0.93	0.93	0.98	0.98	0.98	0.96	0.98	0.97	0.99	0.98
	AVG.‡	1.06	1.02	1.06	1.02	1.06	1.02	0.93	0.93	0.98	0.98	0.98	0.97	0.98	0.97	0.98	0.98
2014-T6	1	1.02	0.96	1.00	0.95	0.99	0.93	0.92	0.92	0.93	0.94	0.93	0.94	0.94	0.93	0.94	0.93
2024-T62	1	0.99	0.98	1.02	1.00	1.00	1.00	0.95	0.91	0.97	0.95	0.99	0.97	0.96	0.97	0.97	0.99
	AVG.‡	1.00	0.97	1.01	0.98	1.00	0.99	0.94	0.92	0.95	0.94	0.96	0.96	0.95	0.95	0.96	0.96
7075-T6	4	1.06	1.01	1.06	1.00	1.02	1.01	0.94	0.94	0.98	0.98	0.98	0.98	0.98	0.97	0.99	0.99
7079-T6	7	1.06	1.02	1.07	1.03	1.04	1.02	0.92	0.92	0.97	0.97	0.97	0.96	0.96	0.96	0.97	0.97
	AVG.‡	1.06	1.02	1.07	1.02	1.03	1.02	0.93	0.93	0.97	0.97	0.97	0.97	0.97	0.96	0.98	0.98

† Flatwise specimens.
‡ Weighted average.

TABLE LI

RATIOS OF BEARING PROPERTIES* IN THE EDGEWISE DIRECTION TO THOSE IN THE FLATWISE DIRECTION FOR STRESS-RELIEVED STRETCHED PLATE OF SEVERAL ALUMINUM ALLOYS

Alloy and Temper	Sample: Thickness, in.	Sample: Number and Producer	Direction†	Edgewise Properties/Flatwise Properties: BUS(E)/BUS(P) e/D=1.5	BUS(E)/BUS(P) e/D=2.0	BYS(E)/BYS(P) e/D=1.5	BYS(E)/BYS(P) e/D=2.0
2014-T651	1.000	251739	L	0.91	0.90	1.00	0.92
			LT	0.95	0.90	1.00	0.94
	1.001	281398	L	0.92	0.93	1.00	1.03
			LT	0.90	0.94	0.98	1.02
	1.125	281553	L	0.90	0.93	0.94	0.98
			LT	0.95	0.94	0.96	0.97
	1.500	301844	L	0.91	0.94	0.98	1.02
			LT	0.91	0.93	0.97	0.99
	1.501	301652	L	0.86	0.92	§	1.02
			LT	0.87	0.94	§	1.04
	1.891	281486	L	0.90	0.91	0.96	0.98
			LT	0.90	0.95	0.96	1.01
	2.000	281656*	L	0.90	0.94	0.98	1.02
			LT	0.85	0.88	§	0.96
	2.500	281597	L	0.87	0.89	0.95	0.98
			LT	0.83	0.87	§	0.97
2024-T351	1.009	281487	L	0.96	0.96	1.01	1.04
			LT	0.94	0.95	0.95	0.94
	1.015	281510*	L	0.98	1.01	1.02	1.02
			LT	0.91	0.98	1.00	0.96
	1.250	281373	L	0.94	0.99	1.02	1.04
			LT	0.86	0.94	0.96	1.00
	1.500	251697	L	0.83	0.93	0.98	0.94
			LT	0.88	0.90	0.98	0.96
	1.980	301845	L	0.87	0.93	0.98	0.99
			LT	0.89	0.92	0.97	0.98
	2.000	301819	L	0.89	0.95	0.98	0.98
			LT	0.87	0.90	0.97	0.96
	2.000	281844*	L	0.86	0.92	0.97	1.01
			LT	0.86	0.90	0.96	0.95
	2.250	301782	L	0.92	0.98	0.96	0.97
			LT	0.91	0.95	0.94	0.95
	2.515	281749	L	0.89	0.92	0.98	0.95
			LT	0.91	0.96	0.92	0.93
	2.800	301848	L	0.92	0.98	0.94	0.96
			LT	0.92	0.94	0.94	0.95
	3.000	301846	L	0.94	0.96	0.96	0.94
			LT	0.83	0.85	0.95	0.94
2024-T851	1.009	281511	L	0.89	0.93	§	1.01
			LT	0.86	0.93	§	0.99
	1.260	281412	L	0.88	0.91	0.96	1.03
			LT	0.89	0.95	0.98	1.04
	1.500	251697A	L	0.88	0.89	0.93	1.01
			LT	0.83	0.89	§	0.99
	2.250	301783	L	0.84	0.91	§	1.01
			LT	0.85	0.88	§	0.97
	2.515	281750	L	0.86	0.90	§	1.01
			LT	0.86	0.90	§	0.97
7075-T651	1.125	281507*	L	0.94	0.97	1.02	1.06
			LT	0.93	0.99	1.00	1.03
	1.250	251661	L	0.84	0.92	§	1.00
			LT	0.87	0.96	0.96	0.98
	1.250	281384	L	0.94	0.98	0.99	1.03
			LT	0.91	0.99	0.94	0.97
	1.625	281385	L	0.88	0.96	0.96	0.99
			LT	0.88	0.93	0.97	0.96
7075-T651	2.001	281502*	L	0.90	0.95	0.92	1.00
			LT	0.91	0.93	0.95	0.96
	2.250	281417	L	0.92	0.93	0.98	0.96
			LT	0.87	0.93	0.92	0.95
	2.250	281654*	L	0.92	0.96	0.96	0.99
			LT	0.93	0.97	0.95	0.98
	2.269	281411	L	0.94	0.96	0.94	0.98
			LT	0.92	0.97	0.95	0.99
	2.501	301894	L	0.93	0.95	0.97	0.96
			LT	0.82	0.93	0.94	0.95
	2.501	301897	L	0.85	0.93	0.93	0.97
			LT	0.86	0.91	0.94	0.96
	2.773	281491	L	0.86	0.94	§	1.01
			LT	0.86	0.94	0.95	0.95
	3.025	281420	L	0.89	0.95	0.96	0.97
			LT	0.91	0.94	0.94	0.96
	3.953	281684	L	0.91	0.95	0.95	0.99
			LT	0.90	0.93	0.94	0.96
7079-T651	1.008	281399	L	0.94	0.96	0.94	0.98
			LT	0.96	1.01	0.96	1.01
	1.500	251698	L	0.95	0.97	0.99	1.03
			LT	0.94	0.97	0.96	0.98
	1.635	281410	L	0.99	0.95	1.01	1.02
			LT	1.00	0.96	1.01	0.98
	2.000	281500*	L	0.94	0.99	0.97	1.02
			LT	0.90	0.96	0.95	0.98
	2.260	301876	L	0.93	0.93	0.95	0.97
			LT	0.95	0.96	0.97	0.96
	2.500	301877	L	0.91	0.93	0.97	0.99
			LT	0.87	0.92	0.92	0.94
	3.000	281842*	L	0.93	0.96	0.98	1.00
			LT	0.93	0.95	0.98	0.99
	3.000	281554	L	0.85	0.95	§	0.97
			LT	0.90	0.93	0.95	0.97
	3.001	281392	L	0.90	0.94	0.96	0.98
			LT	0.92	0.95	0.96	0.94
	3.277	281582	L	0.90	0.93	0.95	0.98
			LT	0.87	0.92	0.95	0.96
	4.001	281492	L	0.90	0.95	0.95	0.98
			LT	0.93	0.96	0.95	0.99
	4.499	281393	L	1.00	0.97	0.98	0.98
			LT	0.91	0.96	0.94	1.00
	4.770	301879	L	0.87	0.89	0.93	0.96
			LT	0.85	0.92	0.96	0.97
	6.000	301878	L	0.95	0.96	0.97	0.97
			LT	0.93	0.96	0.96	0.98
7178-T651	1.000	251777	L	0.87	0.91	0.98	1.00
			LT	0.81	0.94	§	0.99
	1.250	251736	L	0.89	0.93	0.93	0.99
			LT	0.83	0.92	§	0.95

* From Producer B; all others from Producer A.
† L, longitudinal; LT, long transverse.
§ Failed before reaching 2 per cent offset.
‡ At center of thickness.

TABLE LII

RATIOS OF BEARING PROPERTIES IN THE EDGEWISE DIRECTION TO THOSE IN THE FLATWISE DIRECTION FOR PLATE OF SEVERAL ALUMINUM ALLOYS IN THE "HEAT-TREATED-BY-USER" TEMPER

Alloy and Temper	Sample† Thickness, in.	Sample† Number	Direction*	Edgewise Properties/Flatwise Properties: BUS(E)/BUS(F) e/D= 1.5	BUS(E)/BUS(F) e/D= 2.0	BYS(E)/BYS(F) e/D= 1.5	BYS(E)/BYS(F) e/D= 2.0
2014-T6	1.001	2813664	L	0.89	0.92	0.99	0.99
			LT	0.84	0.90	‡	0.97
	2.500	2815474	L	0.90	0.93	0.96	0.95
			LT	0.88	0.91	0.96	0.95
2024-T42	1.001	2813771	L	0.95	0.97	1.06§	1.07§
			LT	0.84	0.95	0.96	1.00
	2.001	2813732	L	0.91	1.01	0.96	1.00
			LT	0.92	0.97	0.99	1.00
2024-T62	1.001	2813772	L	0.89	0.93	0.95	0.95
			LT	0.87	0.87	0.97	0.95
	2.001	2813723	L	0.86	0.91	0.97	0.96
			LT	0.89	0.89	0.96	0.96
7075-T6	1.500	2813864	L	0.97	0.95	0.98	0.97
			LT	0.88	0.97	0.97	0.97
	2.250	2813804	L	0.95	0.97	0.97	0.99
			LT	0.92	0.95	0.96	0.95
	2.501	2813634	L	0.91	0.91	0.96	0.97
			LT	0.91	0.94	0.94	0.95
	2.501	2814184	L	0.91	0.92	0.96	0.97
			LT	0.90	0.92	0.90	0.96
7075-T6	3.001	2613674	L	0.88	0.92	0.93	0.99
			LT	0.86	0.89	0.93	0.93
7079-T6	1.001	2613664	L	0.96	0.96	0.96	1.04
			LT	0.99	0.98	0.98	1.01
	1.625	2613914	L	0.97	0.96	0.96	0.99
			LT	0.96	0.93	0.98	0.98
	2.280	3018584	L	0.97	0.94	0.96	0.98
			LT	0.91	0.93	0.96	0.95
	2.500	3018594	L	0.98	0.95	0.98	0.99
			LT	0.97	0.99	0.96	0.97
	3.001	2814234	L	0.91	0.96	0.96	0.96
			LT	0.90	0.97	0.97	0.95
	4.000	3018604	L	0.88	0.93	0.94	0.96
			LT	0.88	0.90	0.91	0.94
	4.040	3018504	L	0.88	0.91	0.95	0.97
			LT	0.89	0.90	0.95	0.98
	4.800	3018514	L	0.96	0.92	0.95	0.99
			LT	0.90	0.94	0.95	0.96

* L, longitudinal; LT, long transverse.
† All samples received in the -O or -F temper (Table I) from Producer A and heat treated to the "heat-treated-by-user" temper by Alcoa Research Laboratories.
§ Failed before reaching 4 per cent offset.
‡ Questionable value; material not available for check test.

TABLE LIII

AVERAGE RATIOS OF BEARING PROPERTIES* IN EDGEWISE DIRECTION TO THOSE IN FLATWISE DIRECTION, IN ALUMINUM ALLOY PLATE

Alloy and Temper	Number of Samples	Average Ratio: Edgewise/Flatwise							
		BUS				BYS			
		e/D=1.5		e/D=2.0		e/D=1.5		e/D=2.0	
		L	LT	L	LT	L	LT	L	LT
2024-T351	11	0.90	0.89	0.96	0.93	0.98	0.96	0.99	0.96
2024-T42	2	0.94	0.93	0.97	0.96	0.96	0.98	1.00	1.00
2014-T651	8	0.90	0.90	0.92	0.92	0.97†	0.97†	0.99	0.99
2024-T851	5	0.87	0.86	0.91	0.91	0.97†	0.98†	1.01	0.99
	AVG.‡	0.89	0.88	0.92	0.92	0.97	0.97	1.00	0.99
7075-T651	13	0.90	0.89	0.95	0.95	0.95†	0.95	0.99	0.97
7079-T651	14	0.93	0.92	0.95	0.95	0.97†	0.96	0.99	0.95
7178-T651	2	0.88	0.82	0.92	0.93	0.96	--†	1.00	0.97
	AVG.‡	0.91	0.90	0.95	0.95	0.96	0.96	0.99	0.97
2014-T6	2	0.90	0.86	0.92	0.91	0.98	0.96†	0.99	0.98
2024-T62	2	0.88	0.88	0.92	0.88	0.96	0.96	0.98	0.97
	AVG.‡	0.89	0.87	0.92	0.90	0.97	0.96	0.98	0.98
7075-T6	5	0.91	0.89	0.93	0.93	0.96	0.94	0.98	0.95
7079-T6	8	0.92	0.91	0.93	0.93	0.96	0.96	0.99	0.97
	AVG.‡	0.92	0.90	0.93	0.93	0.96	0.95	0.98	0.96

* At center of thickness.
† In some tests, specimen failed before yield strength was reached.
‡ Weighted average.

TABLE XIV

RESULTS OF REPEATED STRESS-STRAIN TESTS

Longitudinal

Alloy and Temper	Thickness, in.	ARL Sample Number	Tensile: Ultimate Stress, psi	Tensile: Yield Stress,† psi	Tensile: Elongation in 2 in. or 4D, %	Tensile: Modulus, 10^6 psi, Initial	Tensile: Modulus, 10^6 psi, Final	Compressive: Yield Stress,† psi	Compressive: Modulus, 10^6 psi, Initial	Compressive: Modulus, 10^6 psi, Final
2014-T651	0.312	281401	68 900	65 000	12.0	10.52	10.36	63 500	10.95	10.22
	0.312	301712‡	71 900	62 000	12.5	10.65	10.52	67 500	11.06	11.07
	0.756	281518	68 000	65 300	12.0	10.80	10.55	61 000	11.06	10.95
	1.001	281598	70 800	65 600	12.0	10.77	10.67	64 900	11.09	11.02
	1.891	281436	67 000	63 800	9.5	10.72	10.34	59 600	11.00	10.96
	2.500	281397	69 000	64 700	17.0	10.67	10.61	62 700	10.84	10.58
-T6	0.312	281364A	64 700	61 100	13.0	10.61	10.34	67 700	10.90	10.93
	2.500	281547A	68 900	63 300	10.0	10.64	10.54	67 300	10.90	10.95
2024-T351	0.250	281506*	69 300	55 600	21.0	10.49	10.34	45 300	10.66	10.64
	0.750	281369	67 700	51 300	21.0	10.59	10.34	45 600	10.64	10.79
	1.001	281379	71 400	55 600	18.0	10.73	10.55	45 600	10.82	10.74
	1.250	281374	69 600	54 500	19.0	10.70	10.54	45 200	10.90	10.60
	2.000	281644*	68 200	51 400	21.0	10.63	10.44	44 100	10.73	10.76
	2.515	281749	66 600	52 000	15.5	10.64	10.44	44 500	10.60	10.79
-T851	0.375	281371	72 800	67 300	10.5	10.62	10.43	67 300	10.76	10.87
	0.750	281367	69 900	65 200	9.5	10.67	10.47	64 100	10.93	10.94
	1.001	281376	71 400	64 900	9.5	10.62	10.53	64 300	10.92	10.97
	1.750	281412	71 000	64 800	9.0	10.64	10.66	66 200	10.97	11.09
	2.001	281590	71 000	65 600	10.0	10.68	10.45	64 600	10.99	11.03
	2.525	281750	73 100	62 600	9.0	10.74	10.62	61 900	10.98	10.87
-T42	0.252	281433A	70 700	45 700	22.5	10.75	10.44	47 900	10.78	10.60
	2.001	281372A	69 400	46 000	20.0	10.77	10.67	47 500	10.56	10.66
-T62	0.252	281433B	70 500	56 500	9.0	10.65	10.47	61 000	10.91	11.02
	2.001	281372B	68 200	56 600	11.5	10.71	10.60	60 000	10.94	11.03
7075-T651	0.375	281505*	83 000	75 900	11.0	10.39	10.23	76 300	10.68	10.81
	0.434	281596	84 700	78 600	15.0	10.25	10.03	76 600	10.55	10.57
	0.832	281454	89 400	82 800	11.5	10.49	10.25	77 100	10.65	10.68
	1.250	281734	93 300	85 100	12.0	10.67	10.45	77 100	10.73	10.69
	2.250	281654*	80 800	73 400	11.5	10.20	10.07	69 900	10.54	10.59
	2.772	281491	79 800	70 500	12.0	10.33	10.16	68 500	10.54	10.66
-T6	0.375	281381A	85 000	76 000	17.0	10.21	10.07	82 500	10.54	10.60
	2.501	281383A	82 800	74 200	15.0	10.30	10.17	78 900	10.68	10.70
7079-T651	0.252	281406	80 100	74 800	12.5	10.19	10.05	73 700	10.54	10.63
	0.315	281405	81 200	76 100	14.5	10.23	10.09	75 800	10.64	10.64
	0.750	281676	78 800	72 700	13.5	10.24	10.32	73 000	10.52	10.66
	1.005	281399	79 700	73 600	14.0	10.32	10.25	73 300	10.53	10.61
	3.000	281842‡	78 300	71 200	12.0	10.24	10.19	65 000	10.44	10.51
	4.499	281393	75 300	68 900	13.0	10.20	10.11	65 300	10.50	10.52
-T6	0.252	281422A	77 600	70 000	17.0	10.14	10.05	75 500	10.62	10.66
	1.625	281391A	80 200	71 200	15.5	10.25	10.10	76 100	10.50	10.83
7178-T651	0.312	281501*	86 400	80 500	14.0	10.22	10.14	80 900	10.51	10.52
	0.435	281433	88 100	83 400	15.5	10.24	10.10	84 000	10.70	10.69
	1.060	281657*	91 200	84 300	10.0	10.43	10.39	83 000	10.59	10.64
	1.250	251736	92 700	84 000	9.0	10.45	10.31	78 800	10.80	10.75
-T6	0.250	301830A	89 500	81 200	17.0	10.24	10.05	88 500	10.70	10.72
	0.252	281421A	91 500	83 400	18.0	10.18	10.00	89 600	10.53	10.61

Long-Transverse

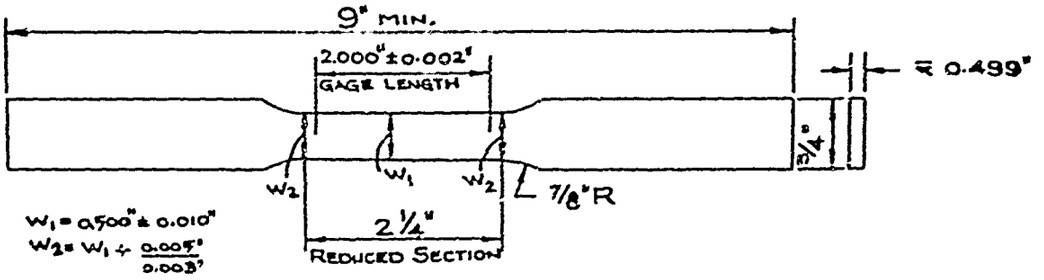
Alloy and Temper	Thickness, in.	ARL Sample Number	Tensile: Ultimate Stress, psi	Tensile: Yield Stress,† psi	Tensile: Elongation in 2 in. or 4D, %	Tensile: Modulus, 10^6 psi, Initial	Tensile: Modulus, 10^6 psi, Final	Compressive: Yield Stress,† psi	Compressive: Modulus, 10^6 psi, Initial	Compressive: Modulus, 10^6 psi, Final
2014-T651	0.312	281401	70 100	63 200	10.5	10.63	10.45	67 200	10.90	10.94
	0.312	301712‡	71 900	65 300	11.0	10.59	10.52	69 200	10.90	10.99
	0.756	281518	68 600	66 900	10.0	10.79	10.57	64 000	11.01	11.02
	1.001	281598	71 400	64 900	11.0	10.56	10.76	66 200	11.03	11.10
	1.891	281436	68 300	61 800	10.0	10.73	10.53	66 200	11.02	11.06
	2.500	281397	69 300	63 000	10.0	10.77	10.68	67 300	11.00	11.10
-T6	0.312	281364A	70 900	62 900	11.0	10.55	10.66	67 900	10.96	10.99
	2.500	281547A	69 100	62 900	9.5	10.76	10.73	66 300	11.10	11.09
2024-T351	0.250	281506*	69 400	47 200	19.0	10.56	10.41	52 300	10.68	10.79
	0.750	281369	69 000	46 000	16.0	10.60	10.74	48 600	10.71	10.71
	1.001	281379	69 500	49 300	15.0	10.82	10.68	52 900	10.92	10.84
	1.250	281374	70 500	48 700	15.5	10.77	10.61	51 500	10.82	10.95
	2.000	281644*	66 900	45 900	12.0	10.70	10.47	48 600	11.07	10.91
	2.515	281749	65 800	47 800	12.0	10.70	10.65	51 400	[illegible]	11.07
-T851	0.375	281371	72 000	66 300	6.5	10.60	10.41	68 300	10.92	10.94
	0.750	281367	70 400	64 200	6.5	10.77	[illegible]	64 000	10.94	10.98
	1.001	281376	70 300	63 300	7.5	10.69	10.65	64 700	11.02	11.06
	1.750	281412	70 500	68 000	6.0	10.68	10.66	66 100	11.13	11.11
	2.001	281590	68 300	64 000	2.5	10.72	10.56	66 000	11.02	11.02
	2.525	281750	68 400	62 500	7.5	10.76	10.60	62 400	10.96	11.04
-T42	0.252	281433A	69 500	44 200	22.0	10.63	10.45	46 500	10.77	10.85
	2.001	281372A	67 800	45 300	19.5	10.75	10.62	48 100	11.02	10.96
-T62	0.252	281433B	70 500	57 000	11.5	10.67	10.57	61 200	10.95	11.12
	2.001	281372B	68 500	56 500	10.5	10.67	10.73	59 000	10.59	10.96
7075-T651	0.375	281505*	81 800	72 200	12.5	10.47	10.20	80 000	10.58	10.91
	0.434	281596	85 000	75 000	15.5	10.38	10.18	81 800	10.67	10.69
	0.832	281454	87 800	79 800	10.0	10.58	10.42	85 000	10.76	10.96
	1.250	281734	86 300	76 600	13.0	10.50	10.61	83 100	10.78	10.99
	2.250	281654*	79 600	70 000	12.0	10.30	10.13	74 700	10.64	10.72
	2.772	281491	80 100	67 800	9.0	10.41	10.33	72 500	10.63	10.68
-T6	0.375	281381A	86 600	75 300	13.0	10.34	10.20	87 300	10.68	10.73
	2.501	281383A	83 800	74 800	13.0	10.40	10.22	81 500	10.64	10.74
7079-T651	0.252	281406	81 600	71 600	13.5	10.42	10.07	77 800	10.66	10.66
	0.315	281405	82 800	74 400	13.0	10.30	10.17	79 500	10.67	10.60
	0.750	281676	80 600	70 300	13.0	10.35	10.33	76 600	10.67	10.76
	1.005	281399	80 300	73 500	13.5	10.43	10.40	75 500	[illegible]	10.70
	3.000	281842‡	75 800	66 300	11.5	10.26	10.22	71 [illegible]	10.59	10.64
	4.499	281393	75 200	64 600	9.0	10.33	10.20	69 700	10.53	10.62
-T6	0.252	281422A	79 200	69 900	15.5	10.20	10.00	76 100	10.70	10.70
	1.625	281391A	80 400	71 900	13.0	10.30	10.21	76 900	10.60	10.84
7178-T651	0.312	281501*	86 500	75 900	13.0	10.30	10.11	83 500	10.79	10.68
	0.435	281433	89 300	79 700	14.5	10.29	10.21	86 200	10.71	10.67
	1.060	281657*	90 600	82 300	11.0	10.56	10.51	88 000	10.79	10.83
	1.250	251736	93 800	82 900	9.0	10.66	10.40	86 400	11.04	11.00
-T6	0.250	301830A	90 300	79 400	13.0	10.34	10.17	87 100	10.74	10.77
	0.252	281421A	91 100	79 600	16.0	10.20	10.02	87 300	10.66	10.71

† Offset equals 0.2 per cent.
* Samples from Producer B.
‡ Samples from Producer C.
All others from Producer A.

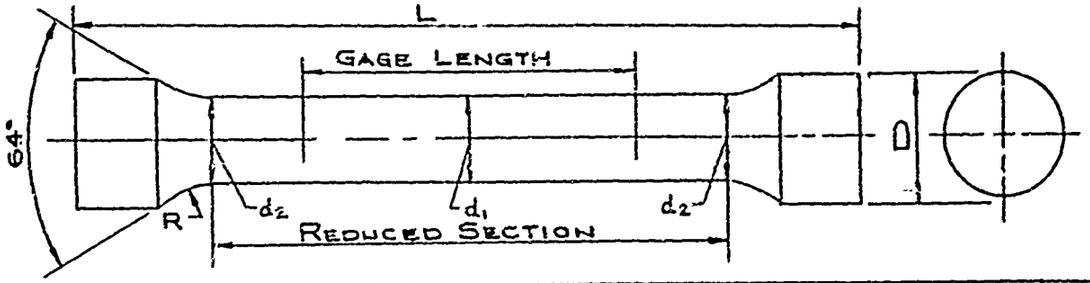
TABLE LV

AVERAGE RESULTS OF MODULUS DETERMINATIONS

Alloy and Temper	Number of Samples	Average Modulus Values, 10^6 psi							
		Tension				Compression			
		Longitudinal		Long-Transverse		Longitudinal		Long-Transverse	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
-TX51 Tempers									
2024-T351	6	10.63	10.44	10.70	10.52	10.76	10.76	10.86	10.88
2014-T651	6	10.69	10.59	10.73	10.64	11.00	10.95	11.02	11.04
2024-T851	6	10.70	10.58	10.77	10.61	10.91	10.96	11.00	11.02
	AVG.	10.70	10.58	10.75	10.62	10.96	10.96	11.01	11.03
7075-T651	6	10.39	10.20	10.44	10.32	10.61	10.67	10.71	10.82
7079-T651	6	10.24	10.17	10.36	10.23	10.53	10.63	10.65	10.66
7178-T651	4	10.34	10.24	10.45	10.31	10.65	10.65	10.83	10.80
	AVG.	10.32	10.20	10.42	10.29	10.60	10.65	10.73	10.76
Heat-Treated-by-User Tempers									
2024-T42	2	10.76	10.56	10.72	10.55	10.82	10.83	10.90	10.92
2014-T6	2	10.62	10.44	10.67	10.69	10.93	10.94	11.03	11.04
2024-T62	2	10.68	10.54	10.67	10.63	10.92	11.02	10.92	11.04
	AVG.	10.65	10.49	10.67	10.66	10.92	10.98	10.98	11.04
7075-T6	2	10.26	10.12	10.37	10.21	10.62	10.65	10.66	10.74
7079-T6	2	10.20	10.08	10.25	10.10	10.56	10.74	10.69	10.77
7178-T6	2	10.21	10.02	10.27	10.10	10.62	10.66	10.70	10.74
	AVG.	10.22	10.07	10.30	10.14	10.60	10.68	10.68	10.75
Weighted Averages - All Tempers									
2014 & 2024		10.68	10.53	10.72	10.60	10.89	10.90	10.96	10.99
7075, 7079 & 7178		10.29	10.16	10.38	10.24	10.55	10.66	10.71	10.75

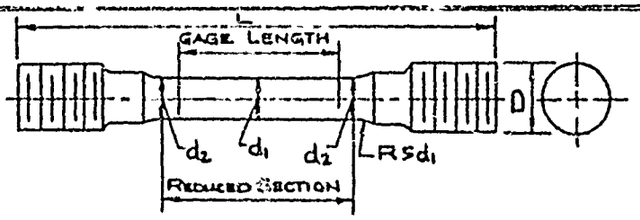


Sheet-Type Specimens



DIAMETER, IN.		GAGE LENGTH, IN.	REDUCED-SECTION LENGTH, IN.	RADIUS (R), IN.	DIAMETER (D), IN.	LENGTH (L), IN.
d_1	d_2					
0.500 ± 0.005	$d_1 + \frac{0.005}{0.003}$	2.000 ± 0.002	3.125	3/8	3/4	4 3/4
0.250 ± 0.003	$d_1 + \frac{0.002}{0.001}$	1.000 ± 0.002	1.5625	3/16	3/8	2 3/8

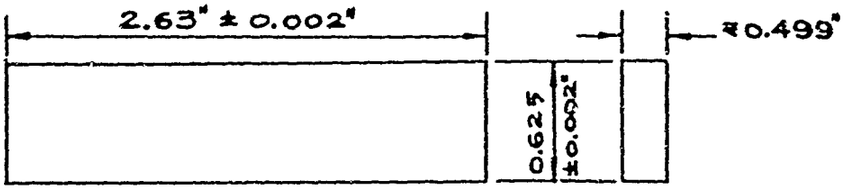
Tapered-Seat Specimens



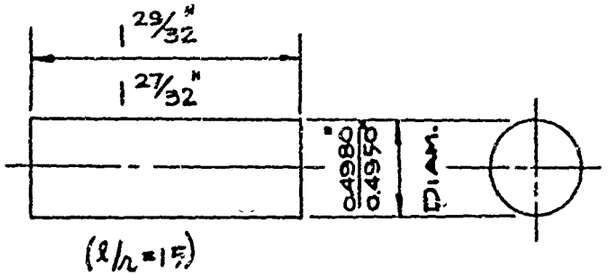
DIAMETER, IN.		GAGE LENGTH, IN.	REDUCED-SECTION LENGTH, IN.	DIAMETER (D), IN.	LENGTH (L), IN.
d_1	d_2				
0.500 ± 0.005	$d_1 + \frac{0.005}{0.003}$	2.000 ± 0.002	2.250	3/4	5 1/2
0.375 ± 0.004	$d_1 + \frac{0.003}{0.002}$	1.500 ± 0.002	1.750	9/16	4 1/4
0.312 ± 0.003	$d_1 + \frac{0.002}{0.001}$	1.250 ± 0.002	1.500	1/2	3 3/4
0.250 ± 0.003	$d_1 + \frac{0.002}{0.001}$	1.000 ± 0.002	1.250	7/16	3 1/8
0.188 ± 0.002	$d_1 + \frac{0.002}{0.001}$	0.750 ± 0.002	1.000	5/16	2 1/2
0.125 ± 0.001	$d_1 + \frac{0.002}{0.001}$	0.500 ± 0.002	0.750	1/4	2

Threaded-End Specimens

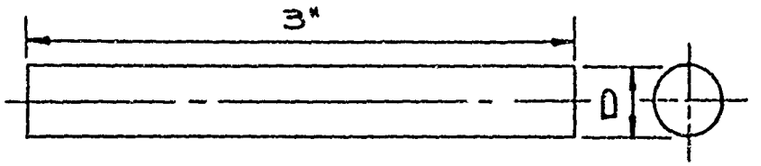
Fig. 1. General Dimensions of Tensile Specimens.



Sheet-Type Compressive Specimen



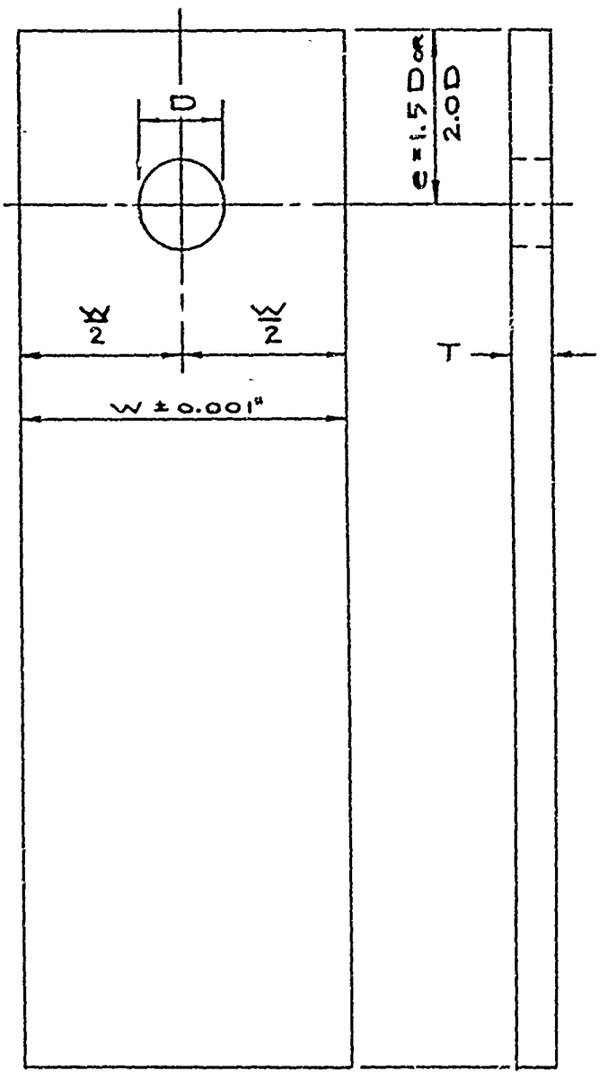
Round Compressive Specimen--1/2-in. diam



Shear Specimen

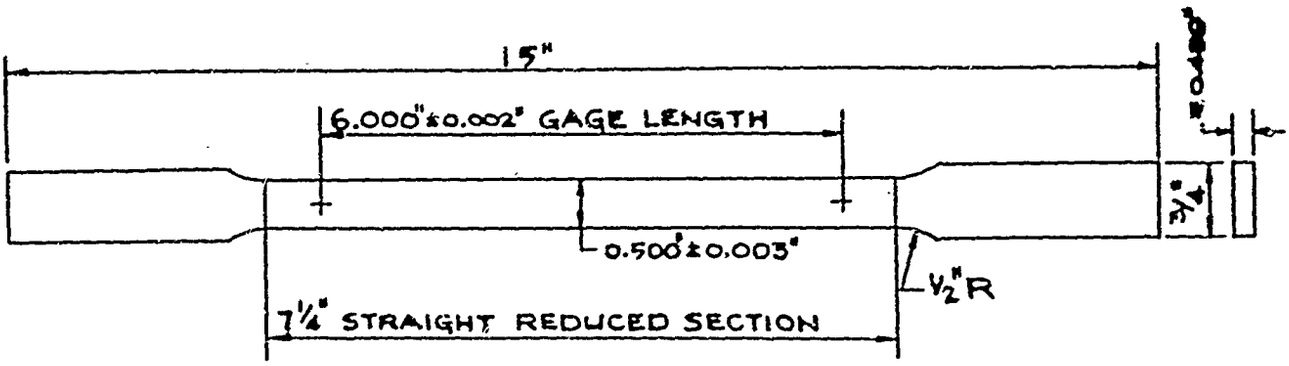
NOMINAL DIAMETER, IN.	D, IN.
3/8	0.3780 / 0.3720
1/4	0.2490 / 0.2480
3/16	0.1865 / 0.1855

Fig. 2. General Dimensions of Compressive and Shear Specimens.

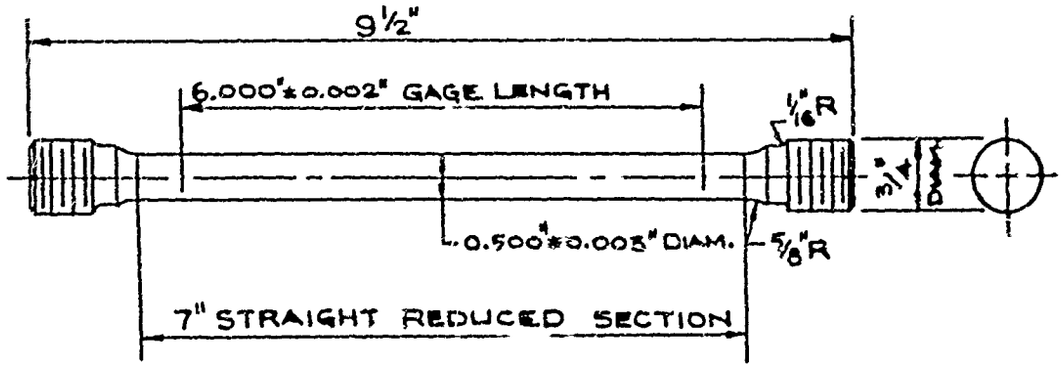


Type	T, in.	W, in.	D, in.
A	0.064	1	$\frac{0.2500}{0.2505}$
B	0.094	1	$\frac{0.2500}{0.2505}$
D	0.094	1-1/2	$\frac{0.3750}{0.3755}$
F	0.250	2	$\frac{0.5000}{0.5005}$

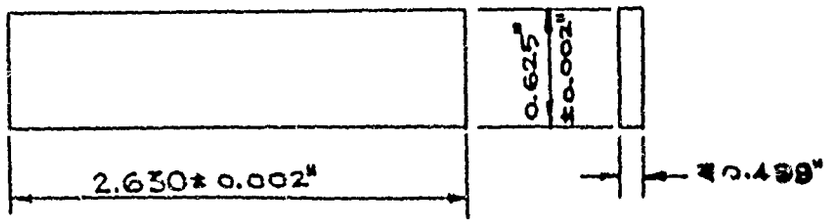
Fig. 3. General Dimensions of Bearing Specimens.



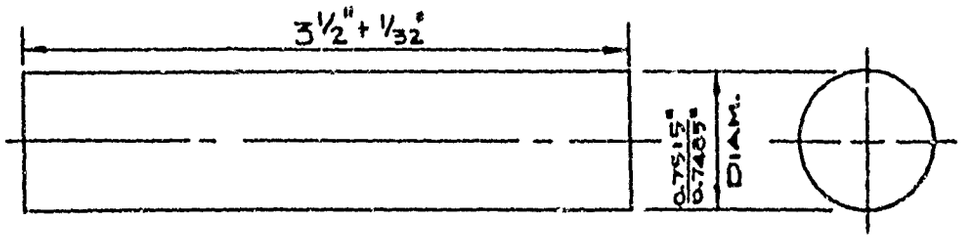
Sheet-Type Tensile Modulus Specimen



Round Tensile Modulus Specimen--1/2-in. diam



Sheet-Type Compressive Modulus Specimen



Round Compressive Modulus Specimen--3/4-in. diam

Fig. 4. Tensile and Compressive Modulus Specimens.

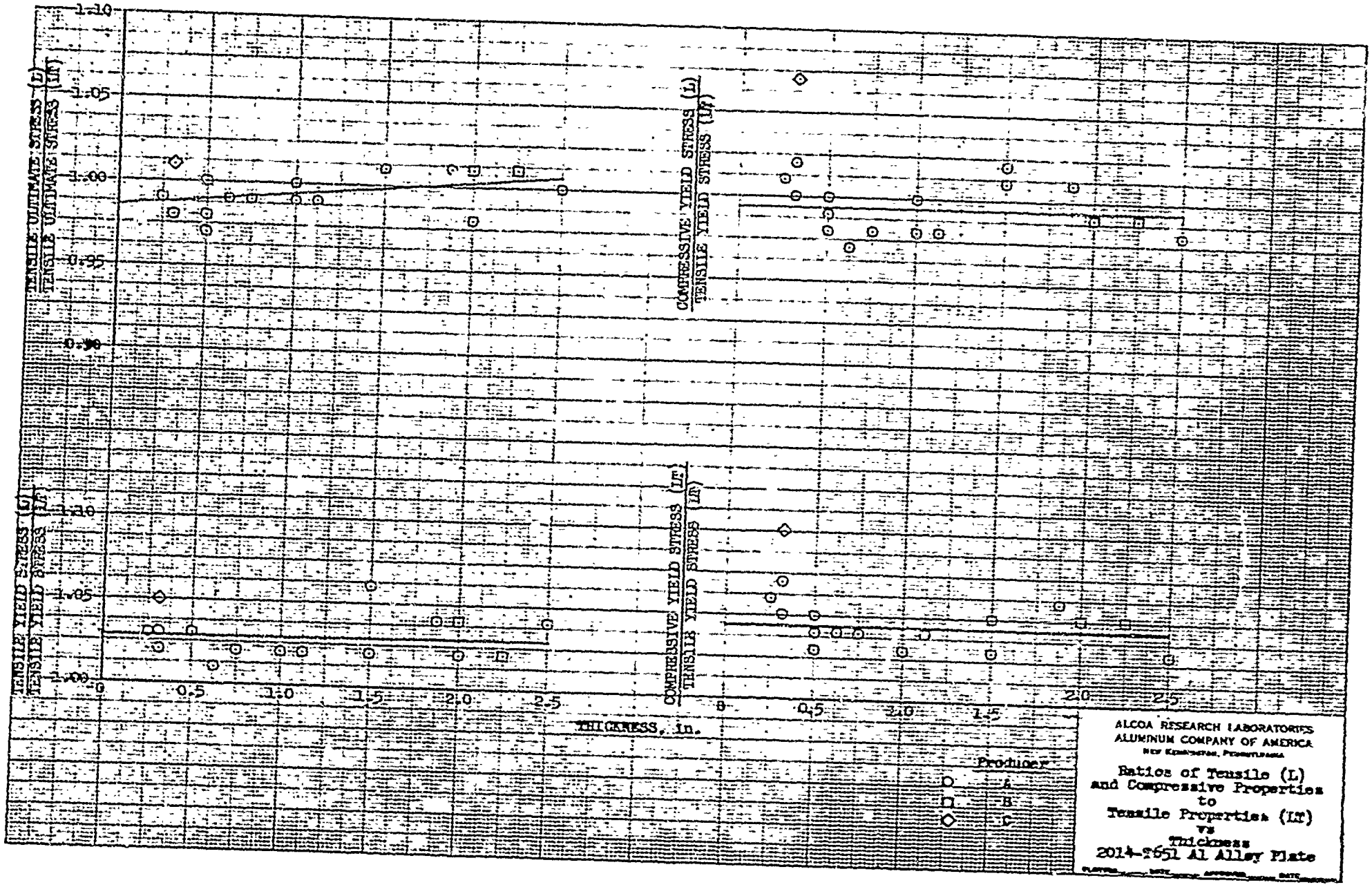

TENSILE ULTIMATE STRESS (T)
TENSILE ULTIMATE STRESS (LT)
TENSILE YIELD STRESS (T)
TENSILE YIELD STRESS (LT)
COMPRESSIVE YIELD STRESS (T)
TENSILE YIELD STRESS (T)
COMPRESSIVE YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
1.10
1.05
1.00
0.95
0.90
0
0.5
1.0
1.5
2.0
2.5
THICKNESS, in.
Producer
A
B
C
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
Ratios of Tensile (L) and Compressive Properties to Tensile Properties (LT) vs Thickness
2014-T651 Al Alloy Plate

Fig. 5

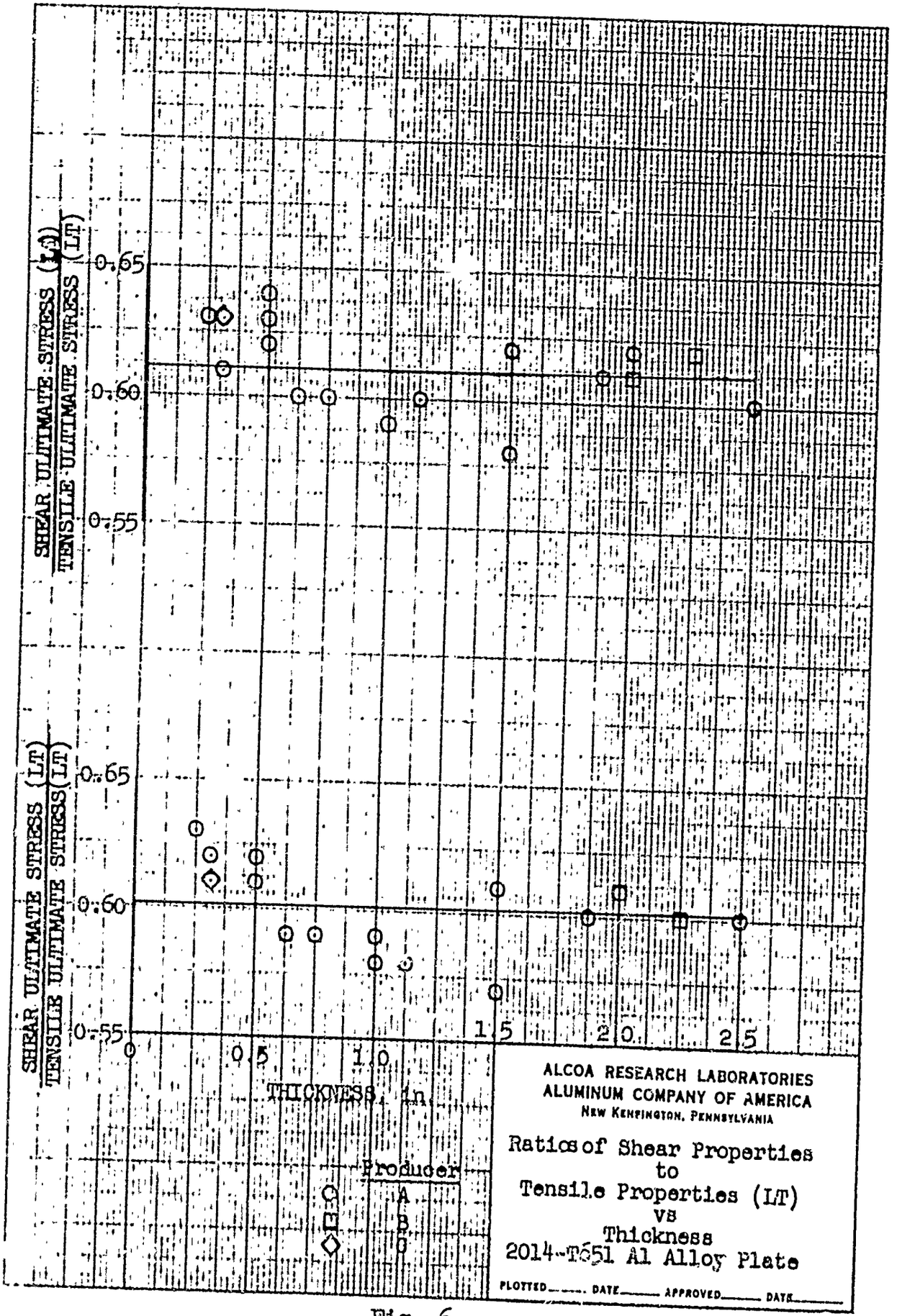
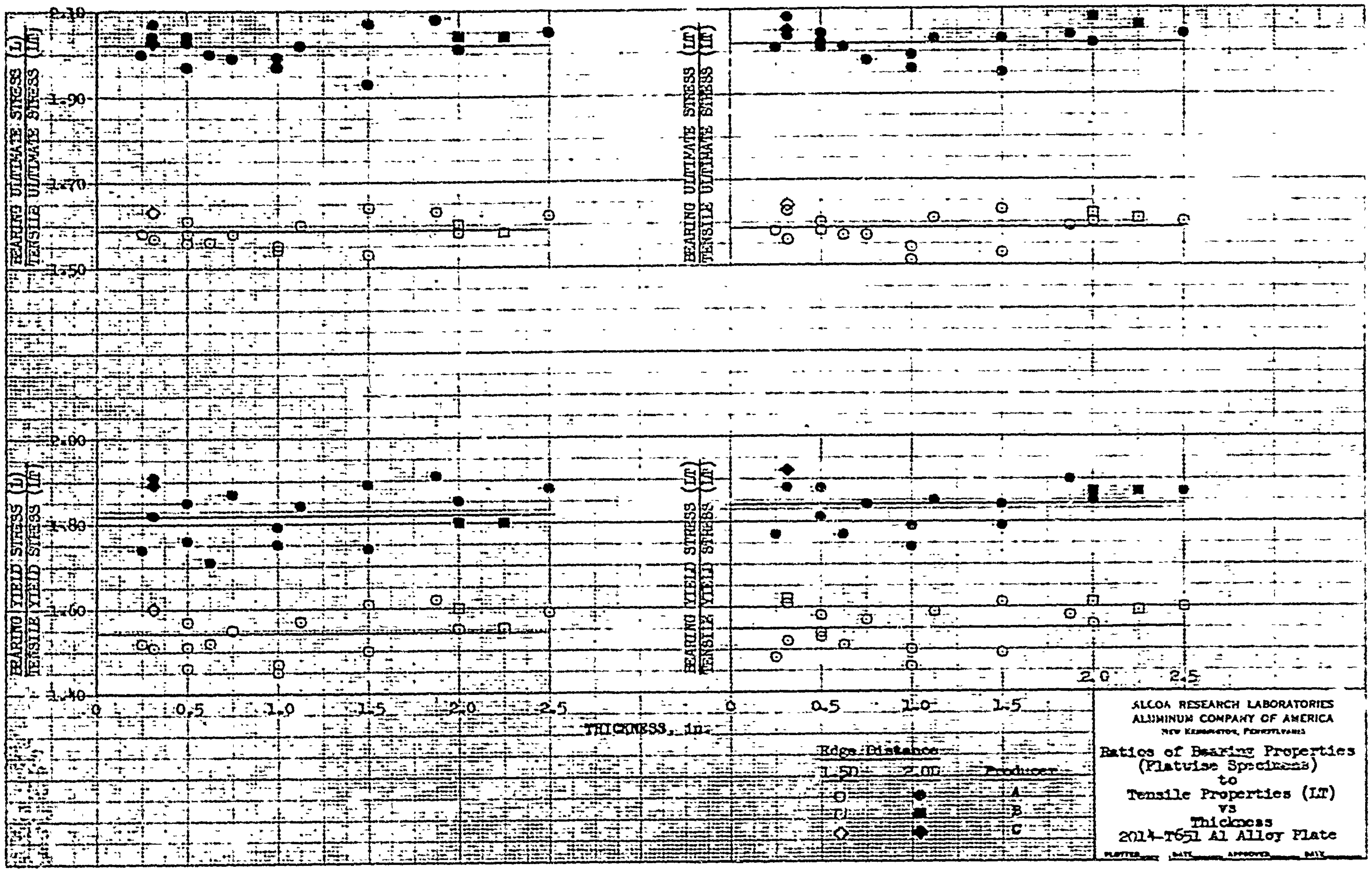

SHEAR ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
0.65
0.60
0.55
0.5
1.0
1.5
2.0
2.5
THICKNESS, in.
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Shear Properties
to
Tensile Properties (LT)
vs
Thickness
2014-T651 Al Alloy Plate
PLOTTED DATE APPROVED DATE

Fig. 6

Fig. 7


BEARING ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
BEARING ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
BEARING YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
BEARING YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
2.10
1.90
1.70
1.50
2.00
1.80
1.60
1.40
0
0.5
1.0
1.5
2.0
2.5
THICKNESS, in.
Edge Distance
1.50
2.00
Producer
A
B
C
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
Ratios of Bearing Properties
(Flatwise Specimens)
to
Tensile Properties (LT)
vs
Thickness
2014-T651 Al Alloy Plate

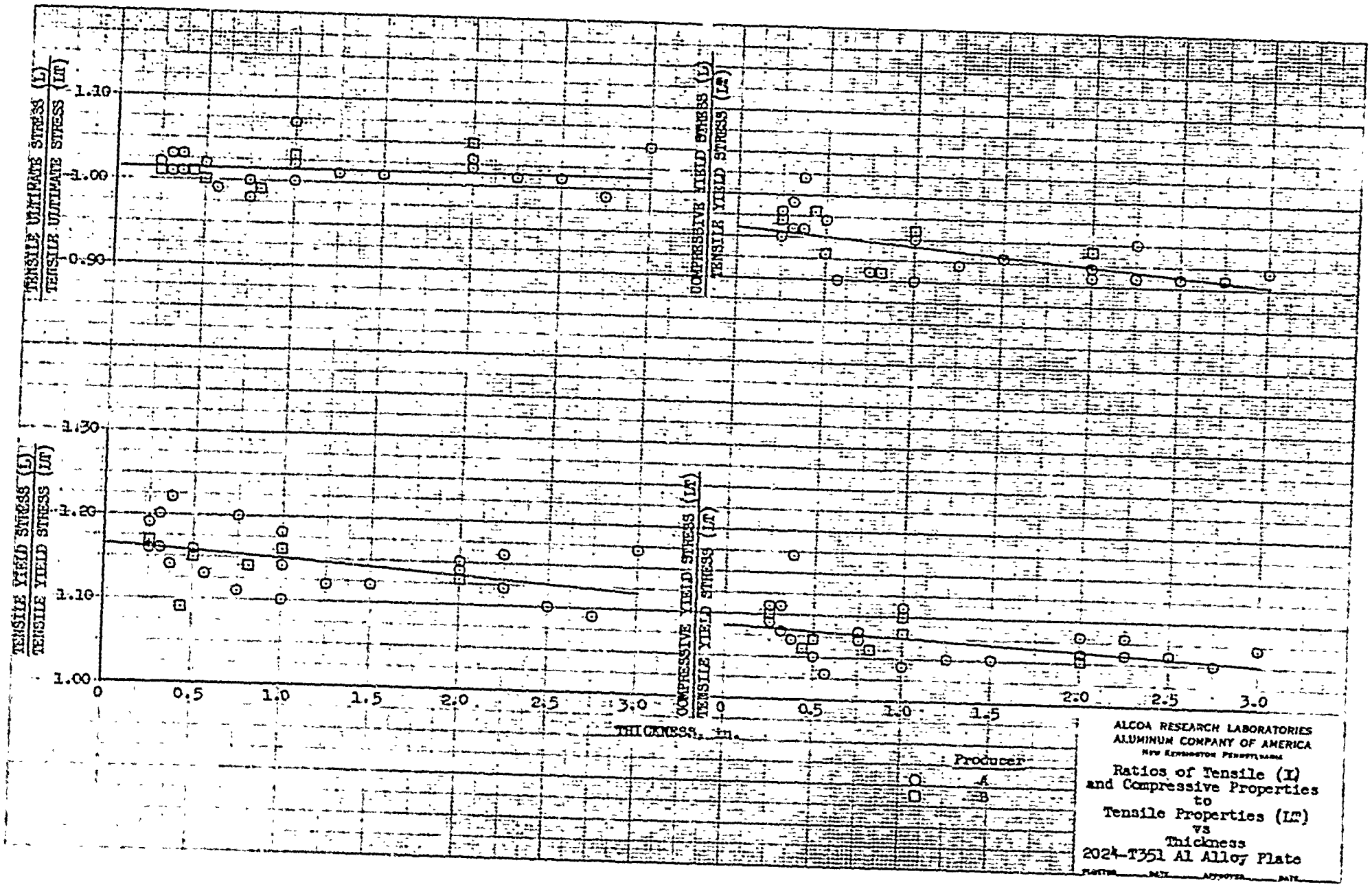

TENSILE ULTIMATE STRESS (L) / TENSILE ULTIMATE STRESS (LT)
1.10
1.00
0.90
COMPRESSIVE YIELD STRESS (L) / TENSILE YIELD STRESS (L*)
TENSILE YIELD STRESS (L*)
TENSILE YIELD STRESS (L) / TENSILE YIELD STRESS (LT)
1.30
1.20
1.10
1.00
0
0.5
1.0
1.5
2.0
2.5
3.0
THICKNESS, in.
COMPRESSIVE YIELD STRESS (LT) / TENSILE YIELD STRESS (LT)
0
0.5
1.0
1.5
2.0
2.5
3.0
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
New Kensington Pennsylvania
Ratios of Tensile (L) and Compressive Properties to Tensile Properties (LT) vs Thickness
2024-T351 Al Alloy Plate
DRAWN DATE APPROVED DATE

Fig. 8

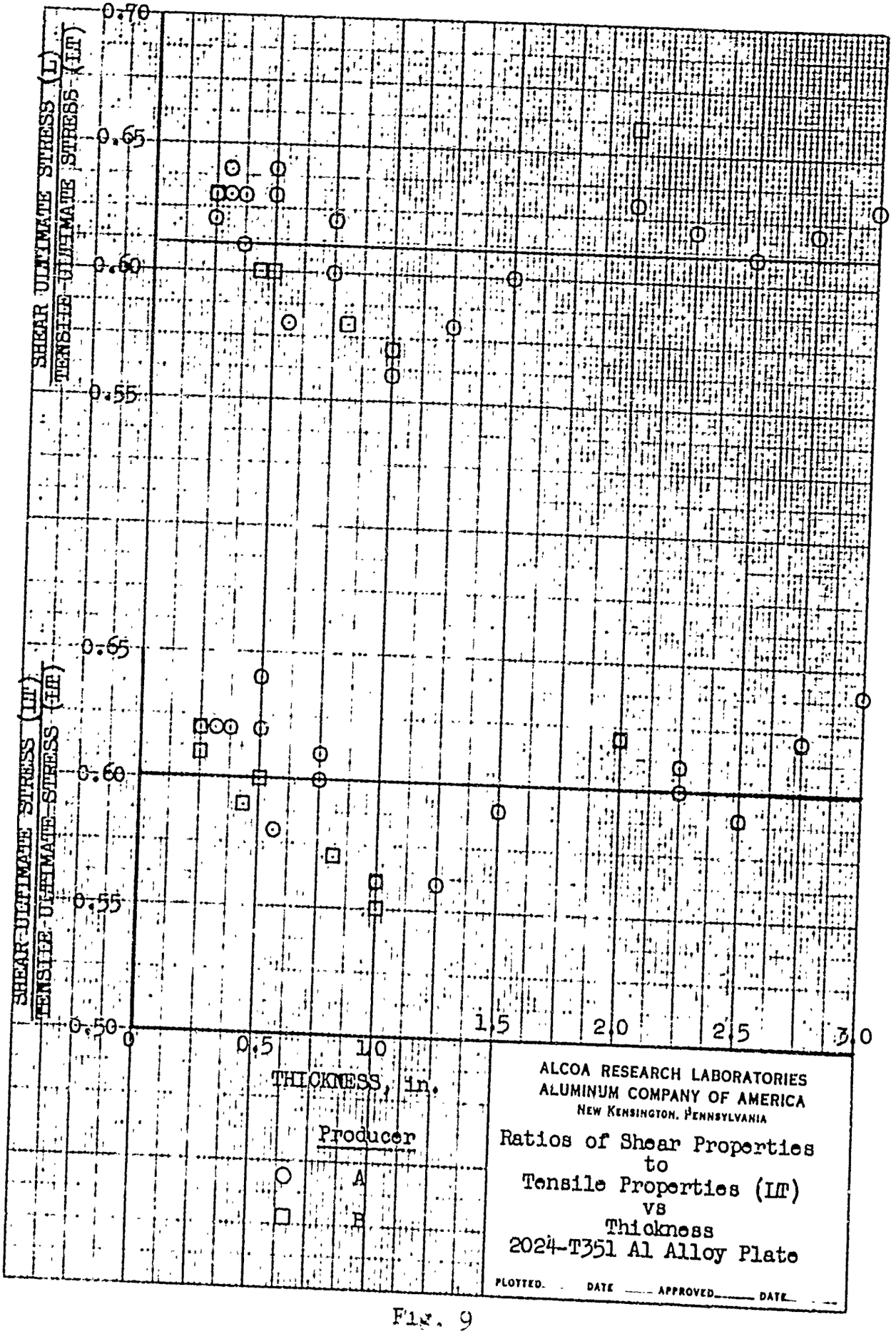

SHEAR ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
SHEAR ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
0.70
0.65
0.60
0.55
0.65
0.60
0.55
0.50
0
0.5
1.0
1.5
2.0
2.5
3.0
THICKNESS, in.
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Shear Properties
to
Tensile Properties (LT)
vs
Thickness
2024-T351 Al Alloy Plate
PLOTTED. DATE APPROVED DATE

Fig. 9

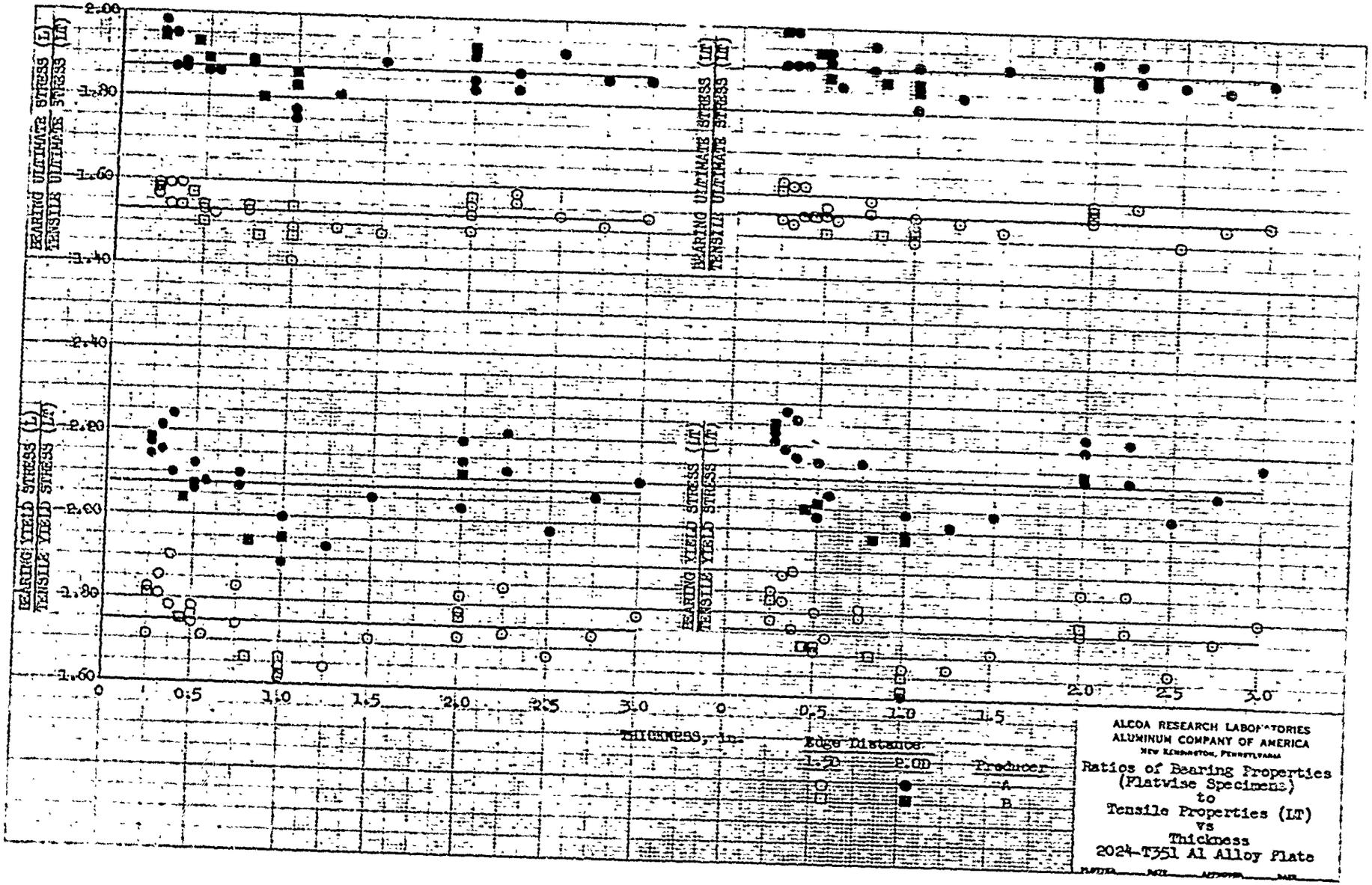

BEARING ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
BEARING YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
BEARING ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
BEARING YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
2.00
1.80
1.60
1.40
2.40
2.20
2.00
1.80
1.60
0
0.5
1.0
1.5
2.0
2.5
3.0
THICKNESS, in.
Edge Distance
1.5D
2.0D
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Bearing Properties
(Flatwise Specimens)
to
Tensile Properties (LT)
vs
Thickness
2024-T351 Al Alloy Plate

Fig. 10

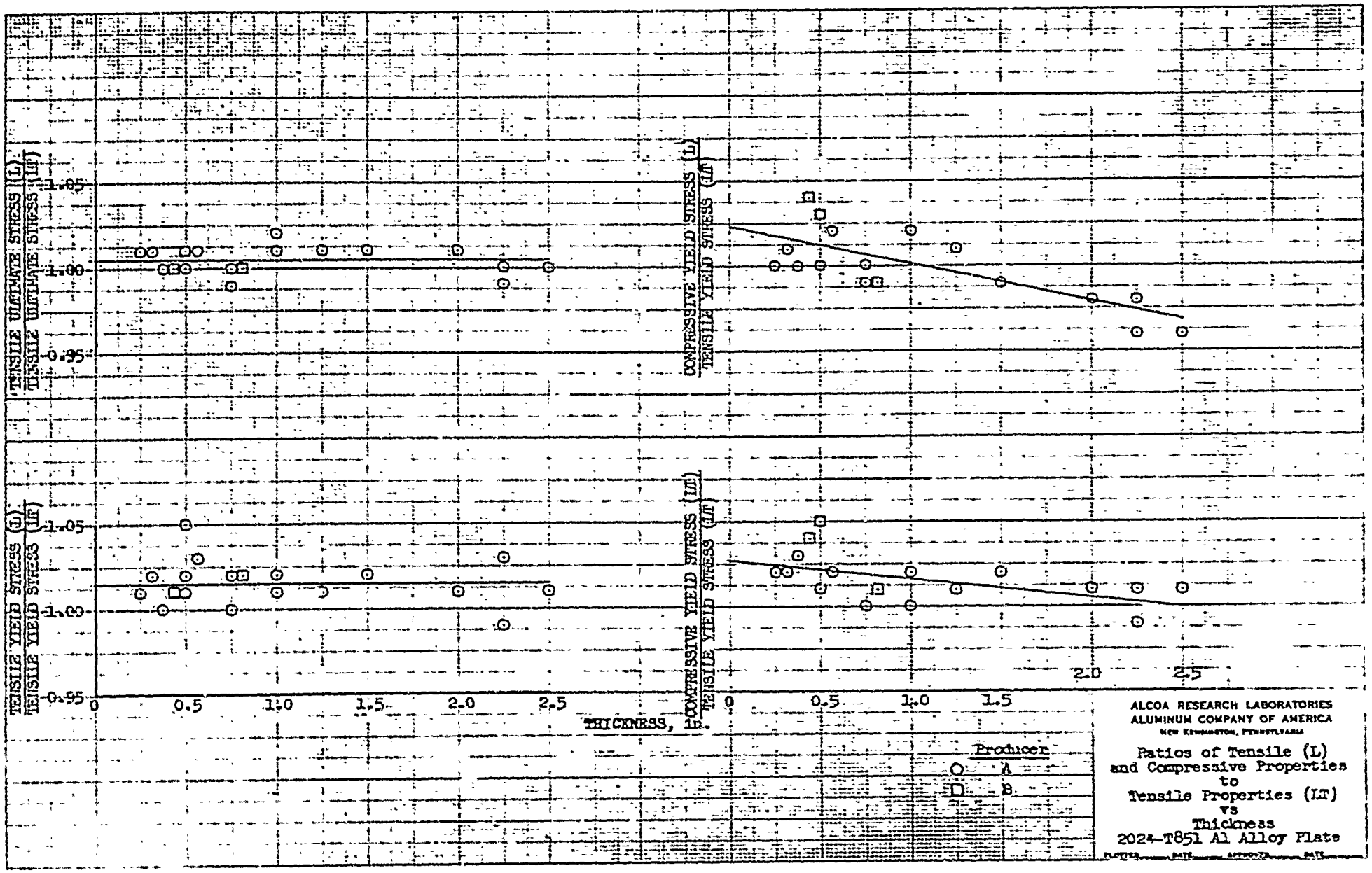

TENSILE ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
TENSILE YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
COMPRESSIVE YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
COMPRESSIVE YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
1.05
1.00
0.95
0
0.5
1.0
1.5
2.0
2.5
THICKNESS, IN.
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
New Kensington, Pennsylvania
Ratios of Tensile (L) and Compressive Properties to Tensile Properties (LT) vs Thickness
2024-T851 Al Alloy Plate

Fig. 11

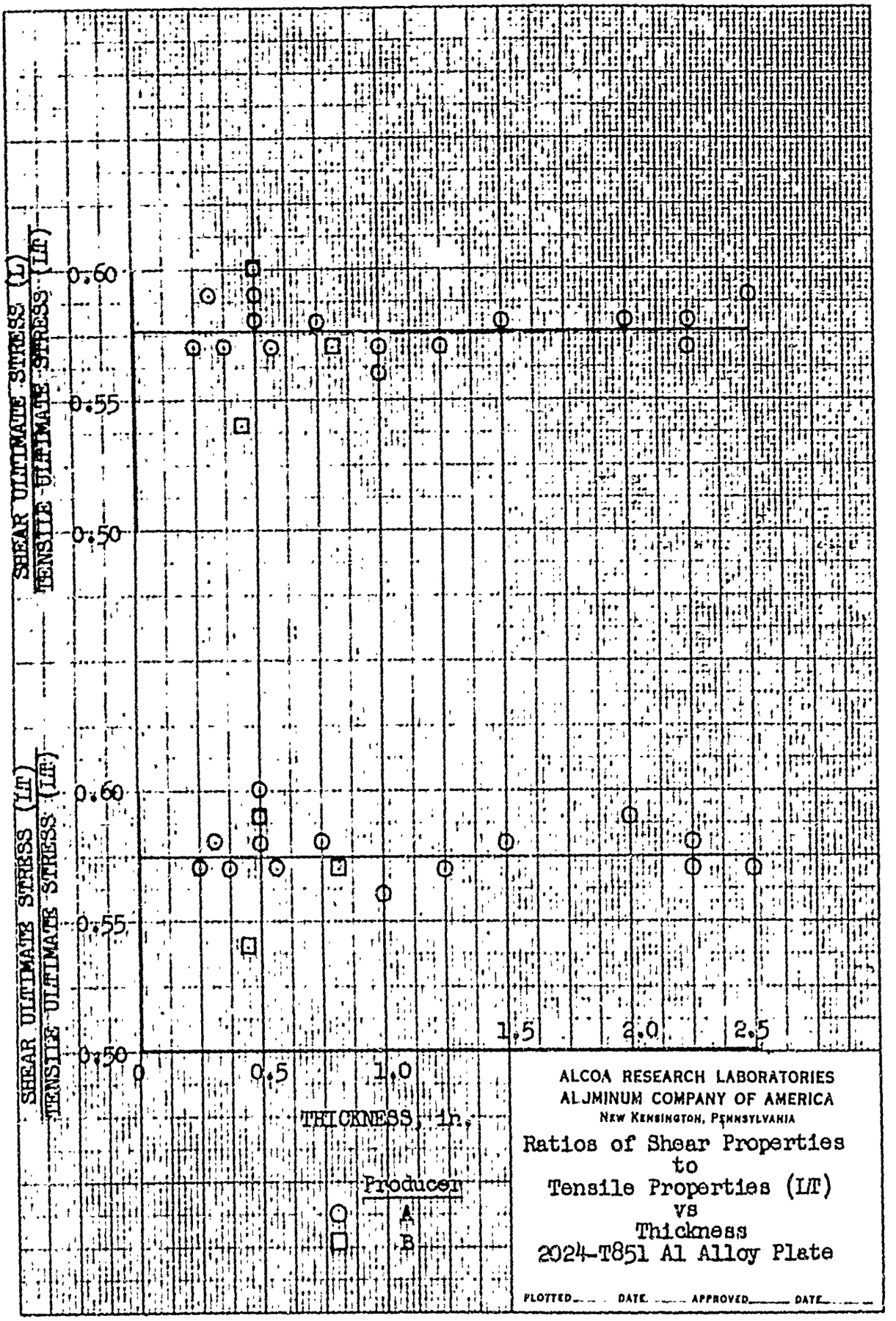

SHEAR ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
SHEAR ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
0.60
0.55
0.50
0.60
0.55
0.50
0
0.5
1.0
1.5
2.0
2.5
THICKNESS, in.
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Shear Properties
to
Tensile Properties (LT)
vs
Thickness
2024-T851 Al Alloy Plate
PLOTTED DATE APPROVED DATE

Fig. 12

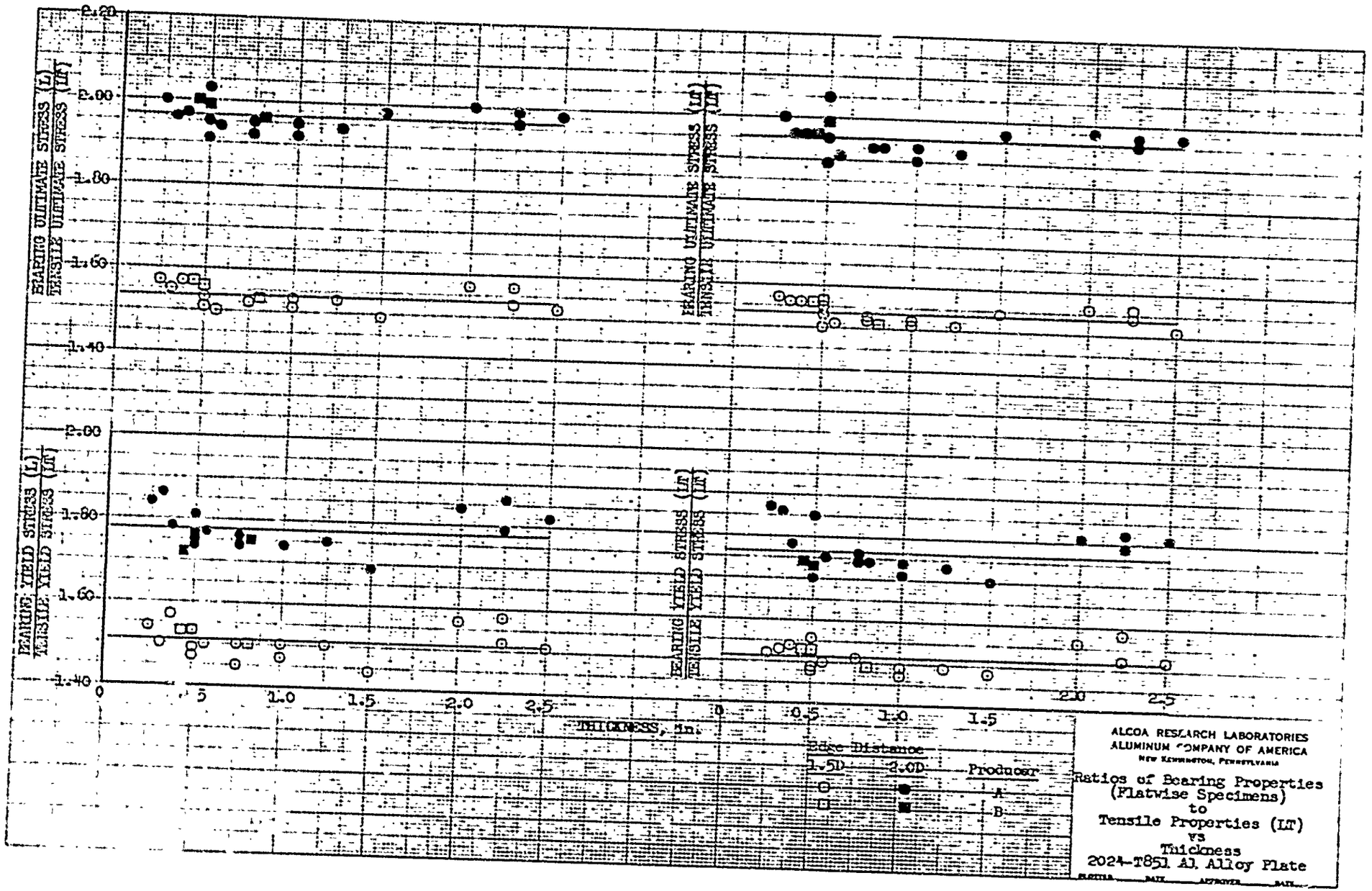

BEARING ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
BEARING YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
2.20
2.00
1.80
1.60
1.40
0
.5
1.0
1.5
2.0
2.5
THICKNESS, in.
BEARING ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
BEARING YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
0
0.5
1.0
1.5
2.0
2.5
Edge Distance
1.5D
2.0D
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Bearing Properties
(Flatwise Specimens)
to
Tensile Properties (LT)
vs
Thickness
2024-T851 Al. Alloy Plate
PLOTTED
DATE
APPROVED
DATE

Fig. 13

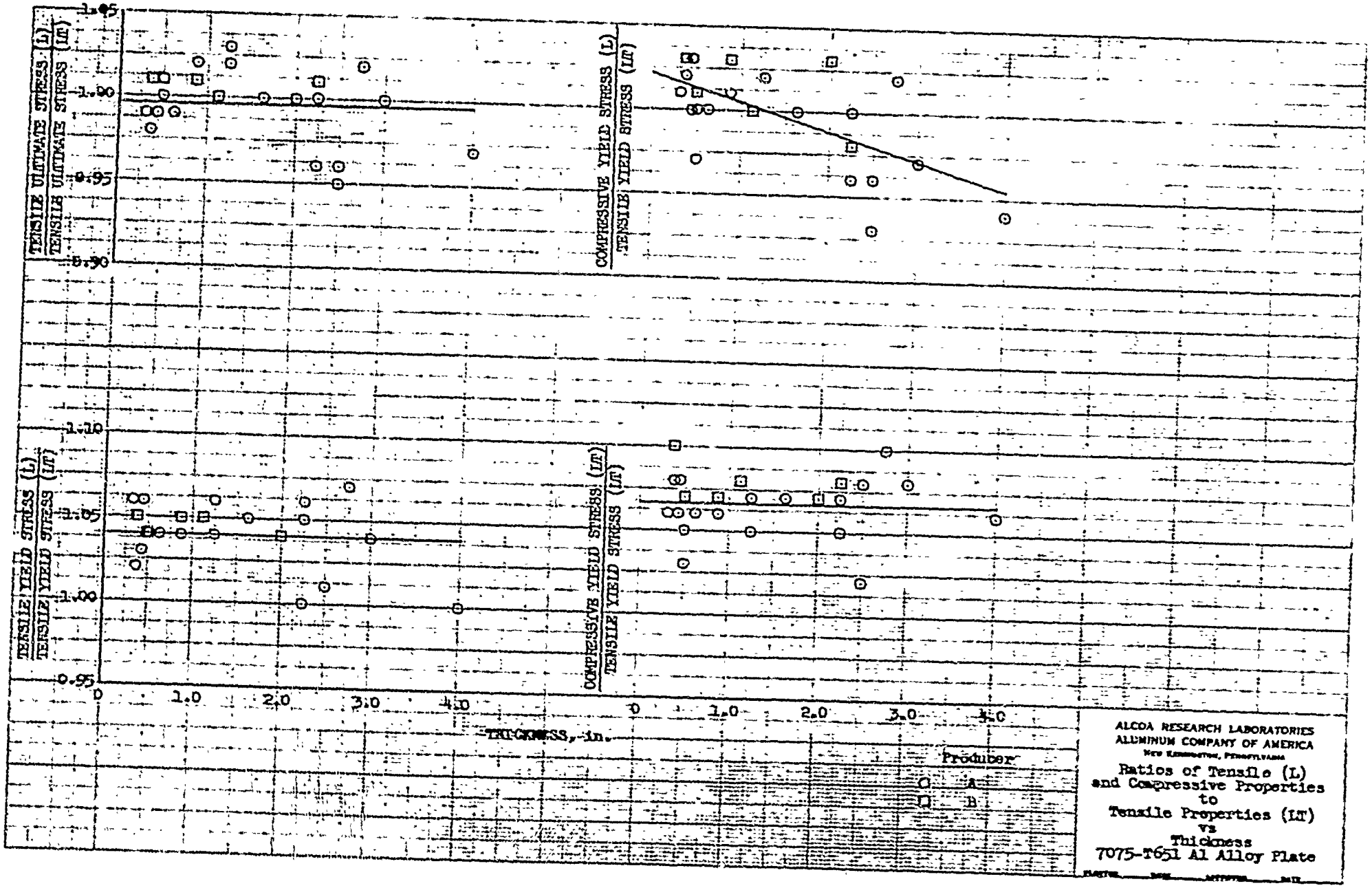

TENSILE ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
COMPRESSIVE YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
TENSILE YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
COMPRESSIVE YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
1.05
1.00
0.95
1.10
1.05
1.00
0.95
0
1.0
2.0
3.0
4.0
THICKNESS, in.
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
New Kensington, Pennsylvania
Ratios of Tensile (L) and Compressive Properties to Tensile Properties (LT) vs Thickness
7075-T651 Al Alloy Plate

Fig. 14

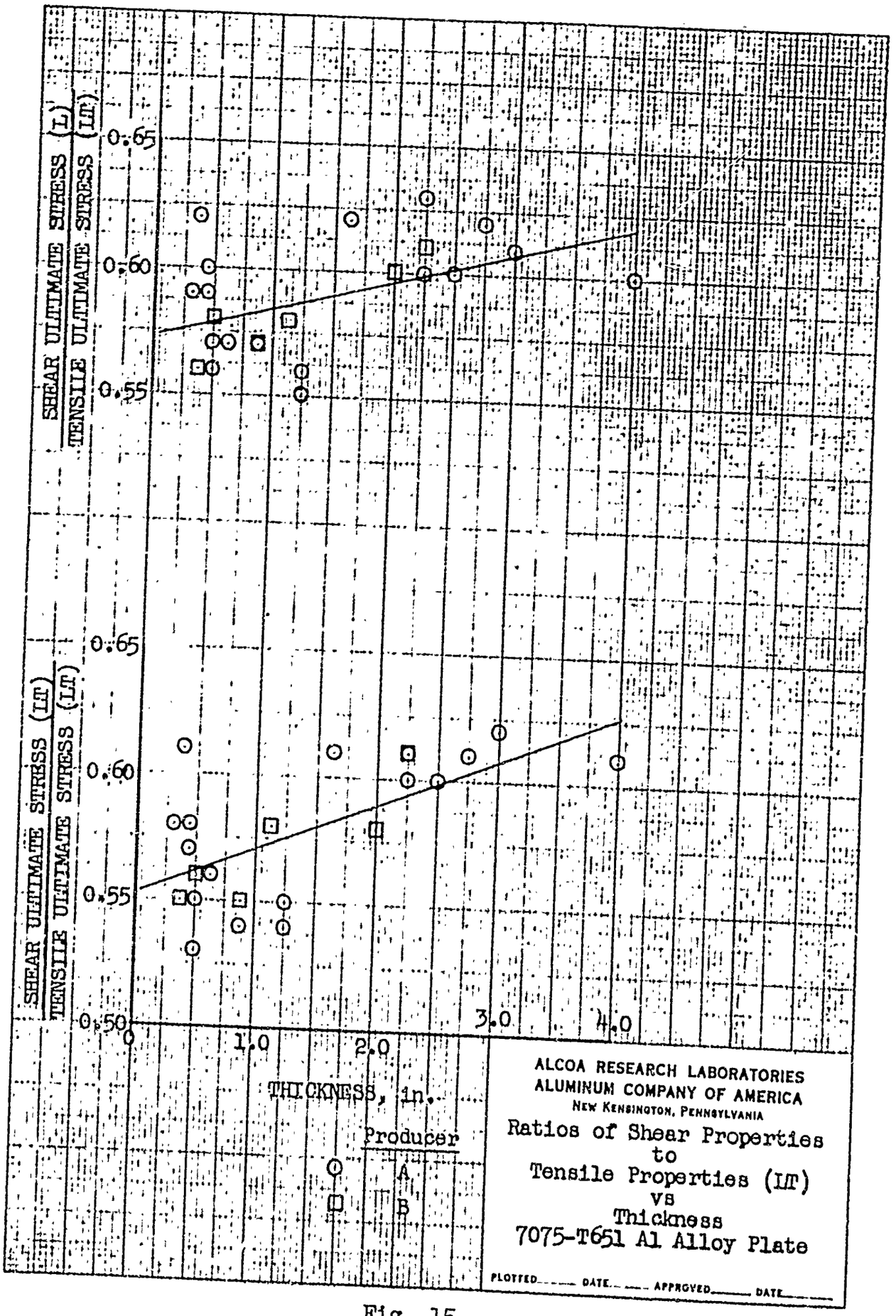

SHEAR ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
0.65
0.60
0.55
SHEAR ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
0.65
0.60
0.55
0.50
0
1.0
2.0
3.0
4.0
THICKNESS, in.
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Shear Properties
to
Tensile Properties (LT)
vs
Thickness
7075-T651 Al Alloy Plate
PLOTTED DATE APPROVED DATE

Fig. 15

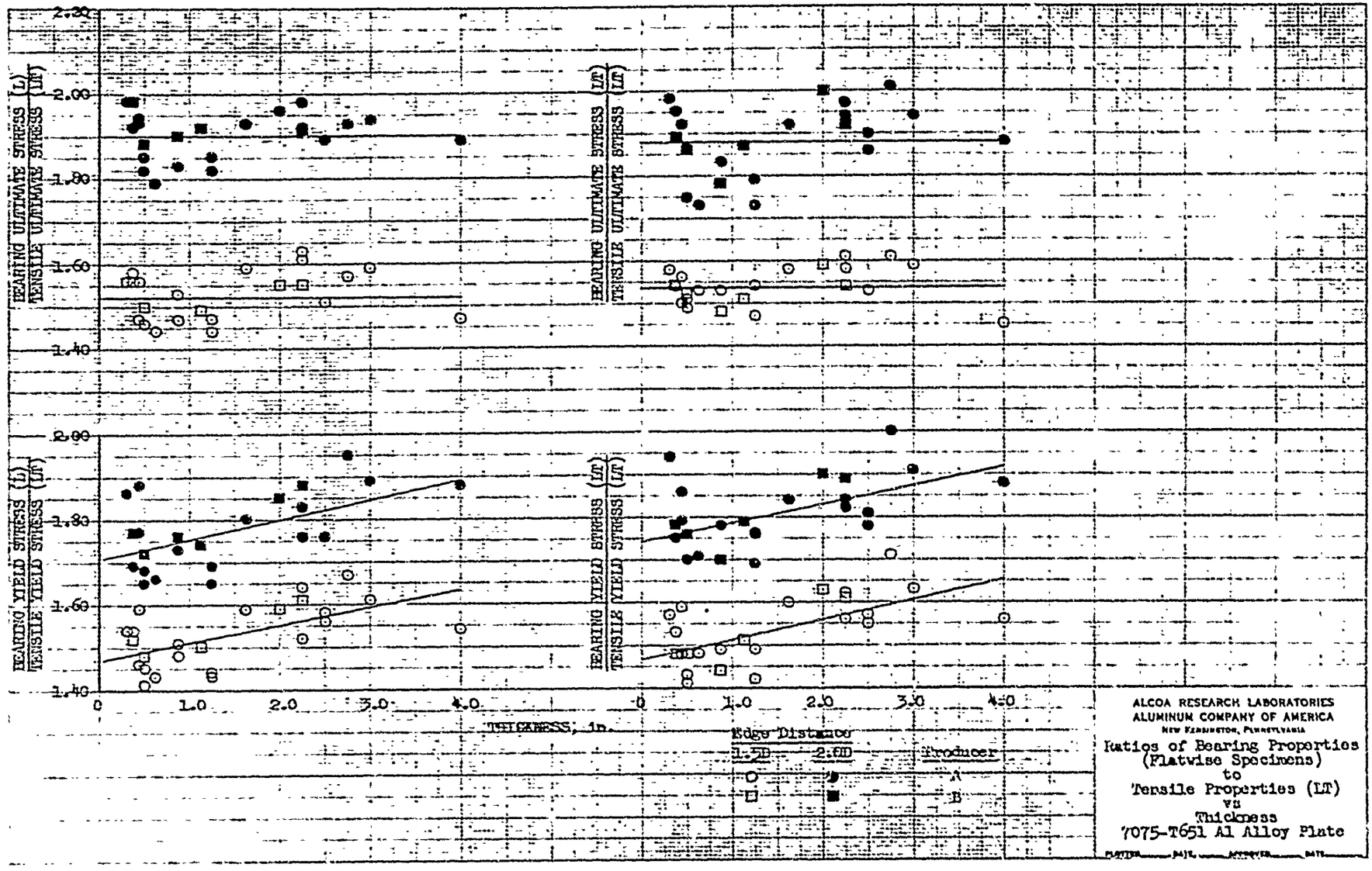

BEARING ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
BEARING ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
BEARING YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
BEARING YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
2.00
1.80
1.60
1.40
1.80
1.60
1.40
0
1.0
2.0
3.0
4.0
THICKNESS, in.
Edge Distance
1.5D
2.0D
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Bearing Properties
(Flatwise Specimens)
to
Tensile Properties (LT)
vs
Thickness
7075-T651 Al Alloy Plate

Fig. 16

Fig. 17

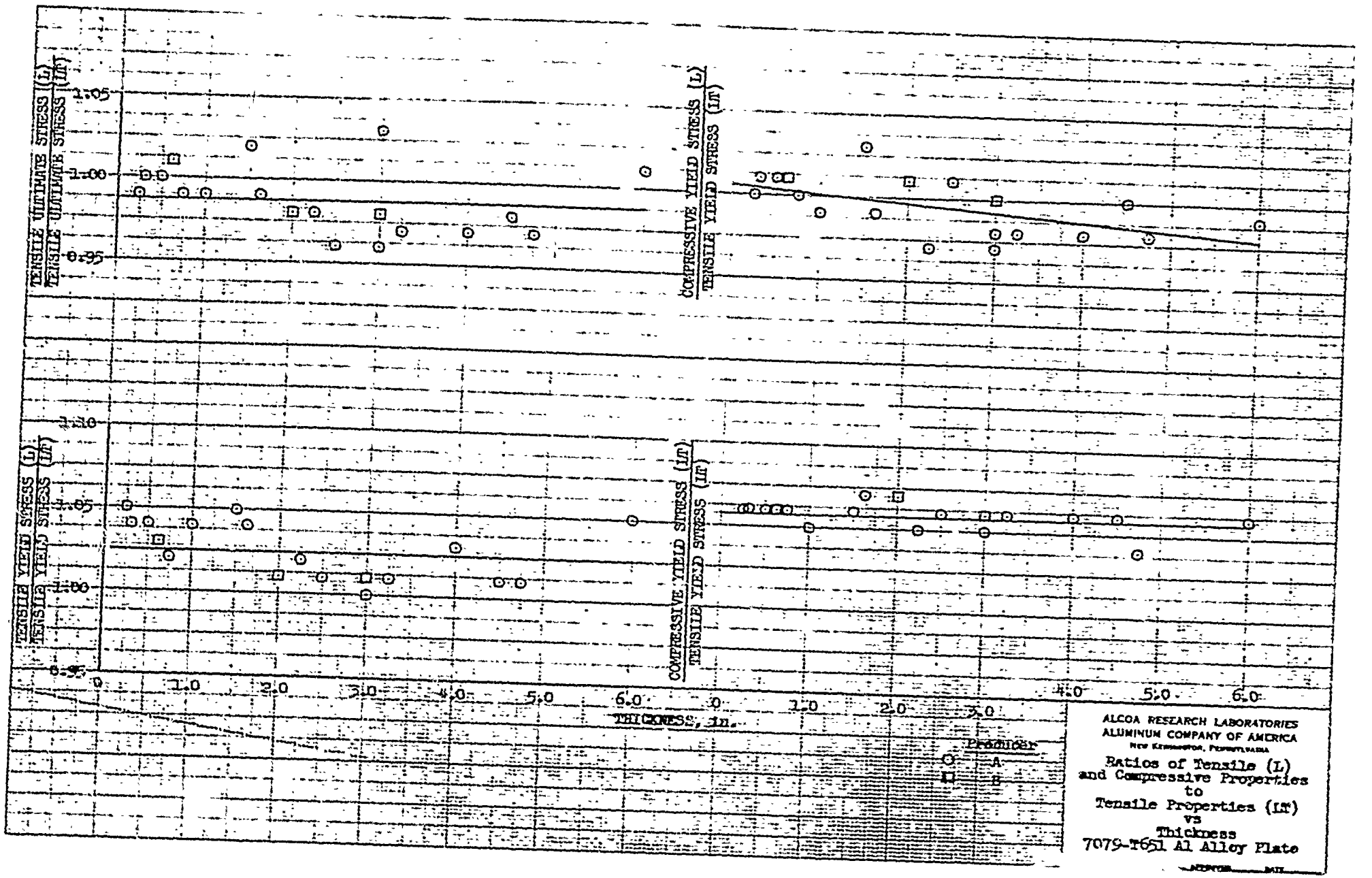

TENSILE ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
1.05
1.00
0.95
TENSILE YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
1.10
1.05
1.00
0.95
0
1.0
2.0
3.0
4.0
5.0
6.0
THICKNESS, in.
COMPRESSIVE YIELD STRESS (L)
TENSILE YIELD STRESS (L)
COMPRESSIVE YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
New Kensington, Pennsylvania
Ratios of Tensile (L) and Compressive Properties to Tensile Properties (LT) vs Thickness
7079-T651 Al Alloy Plate

Fig. 17

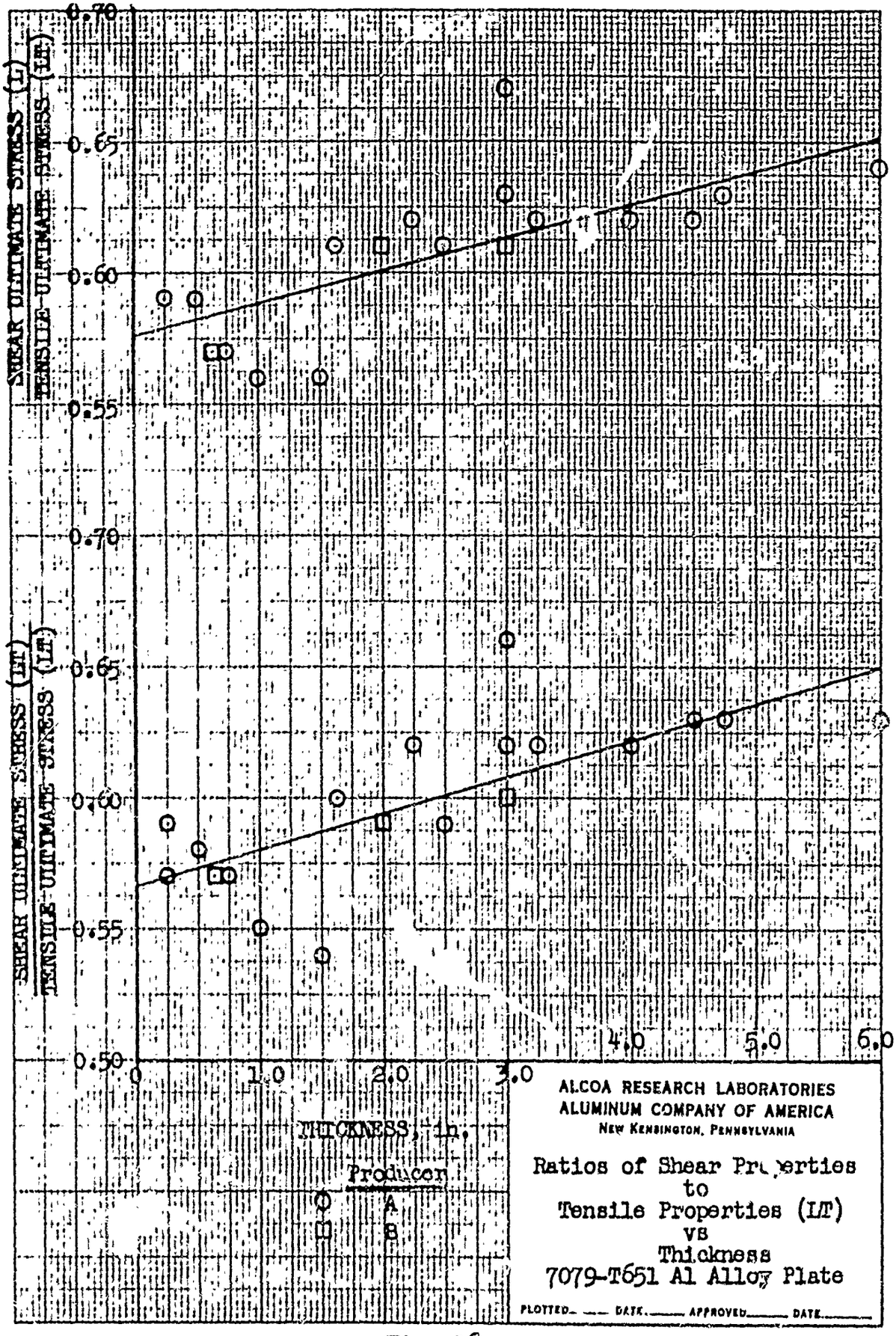


Fig. 18

Fig. 19

7079-T651 Al Alloy Plate Thickness

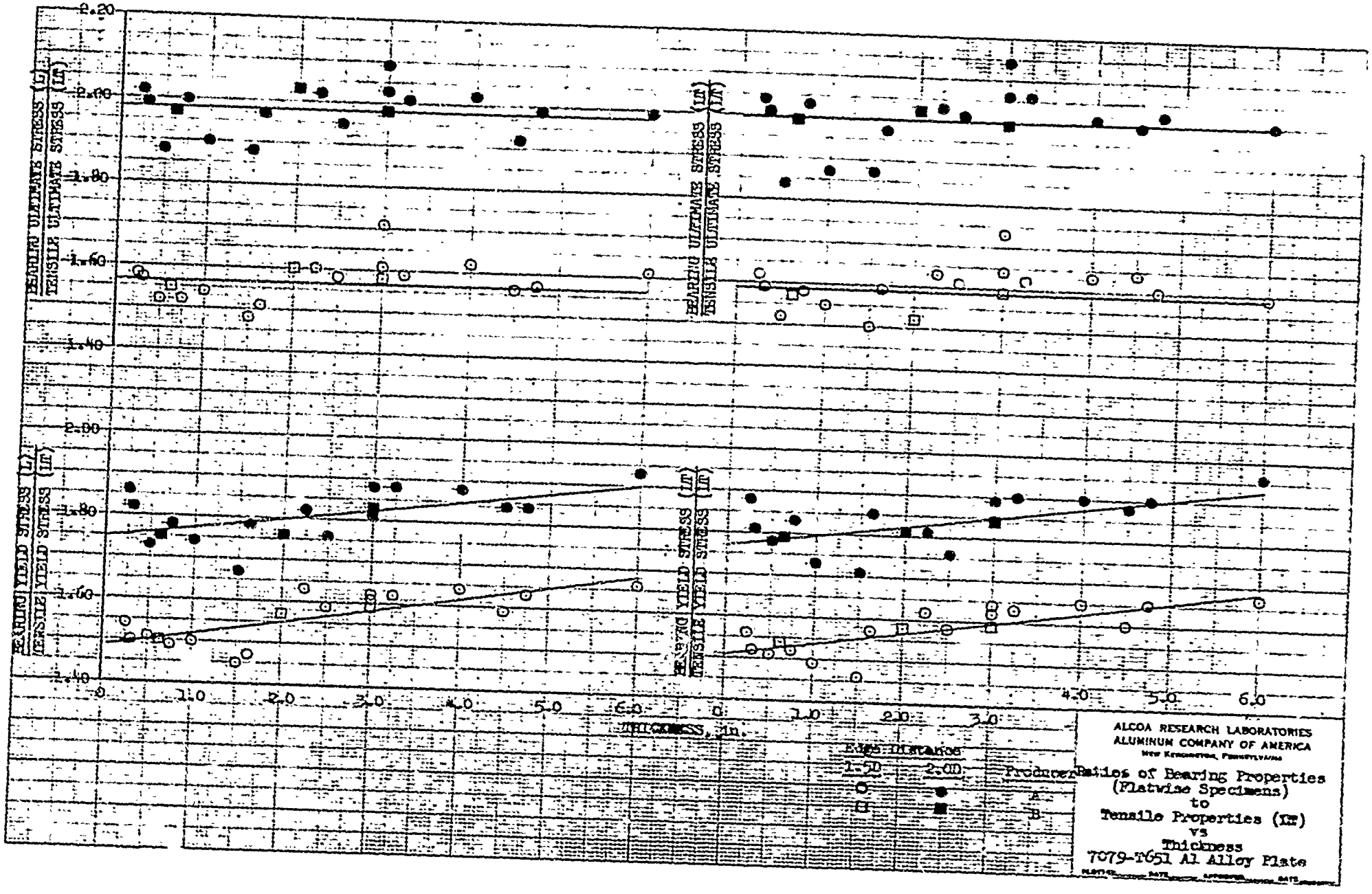

BEARING ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (L)
BEARING ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
BEARING YIELD STRESS (L)
TENSILE YIELD STRESS (L)
BEARING YIELD STRESS (LT)
TENSILE YIELD STRESS (LT)
2.20
2.00
1.80
1.60
1.40
2.00
1.80
1.60
1.40
0
1.0
2.0
3.0
4.0
5.0
6.0
THICKNESS, in.
Edge Distance
1.50
2.00
Producer
A
B
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
New Kensington, Pennsylvania
Ratios of Bearing Properties
(Flatwise Specimens)
to
Tensile Properties (LT)
vs
Thickness
7079-T651 Al Alloy Plate

Fig. 19

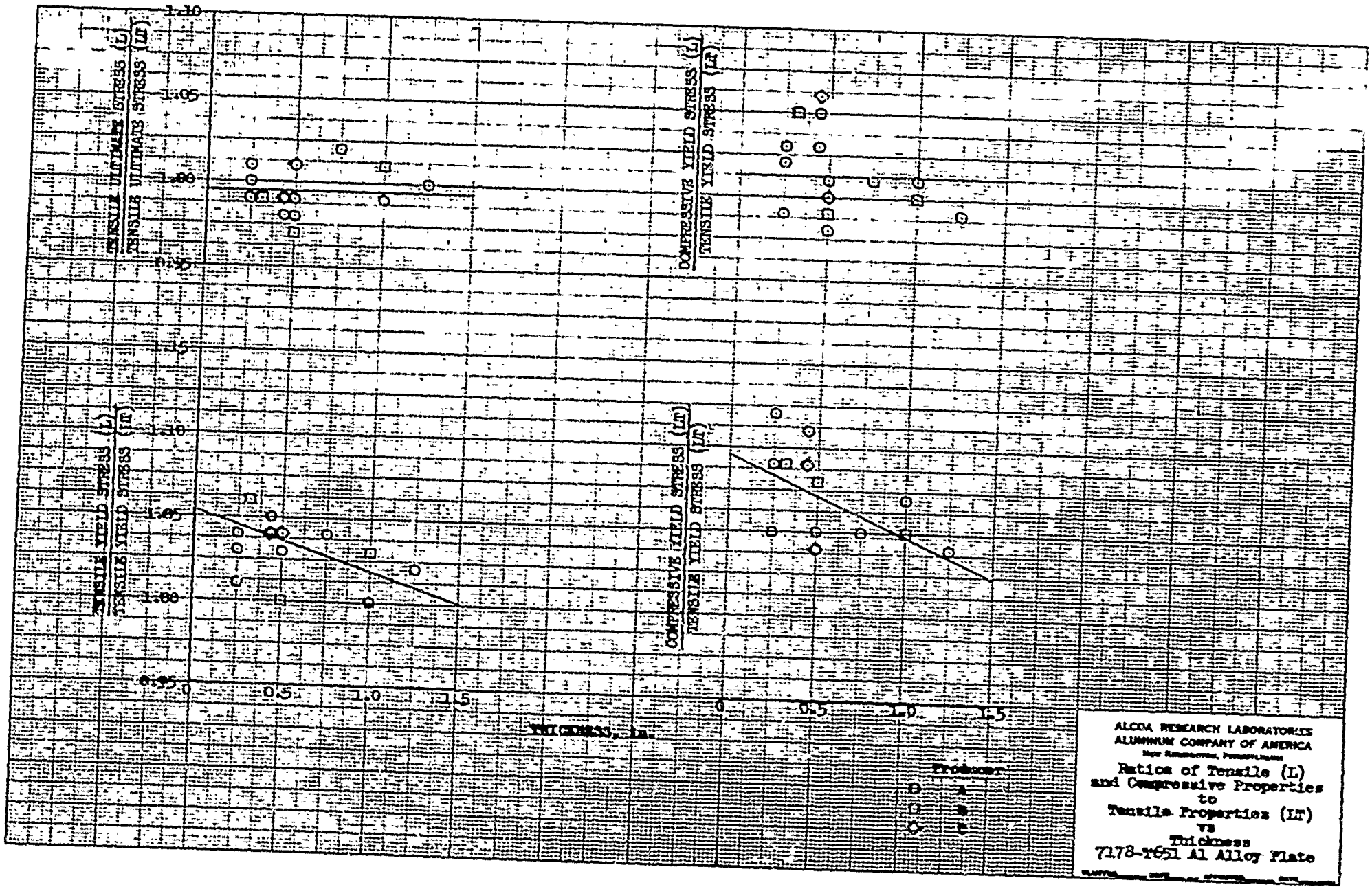

TENSILE ULTIMATE STRESS (L)
TENSILE ULTIMATE STRESS (LT)
TENSILE YIELD STRESS (L)
TENSILE YIELD STRESS (LT)
COMPRESSIVE YIELD STRESS (L)
COMPRESSIVE YIELD STRESS (LT)
1.10
1.05
1.00
0.95
0
0.5
1.0
1.5
THICKNESS, in.
Producer
A
B
C
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
New Kensington, Pennsylvania
Ratios of Tensile (L) and Compressive Properties to Tensile Properties (LT) vs Thickness
7178-T651 Al Alloy Plate

Fig. 20

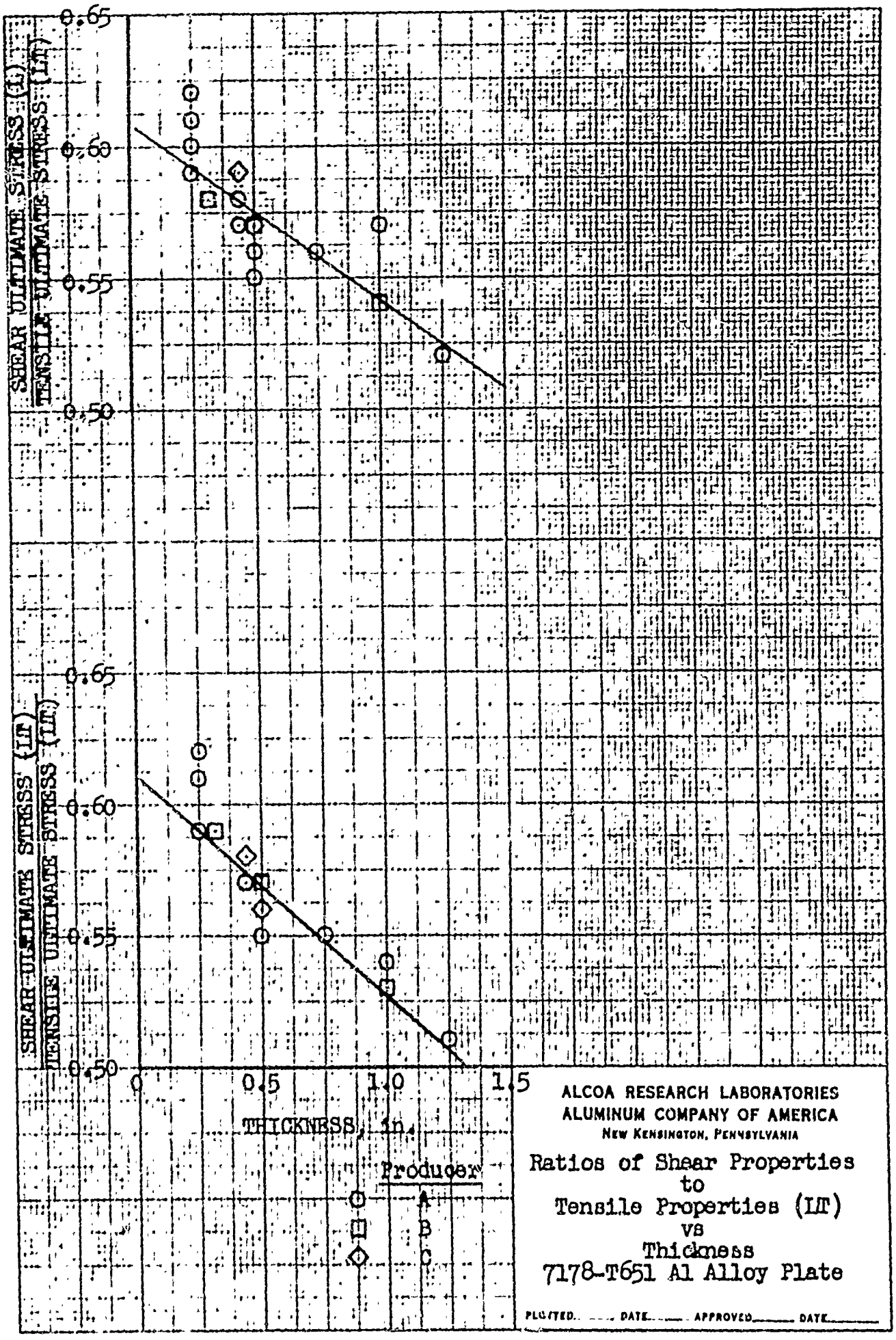

SHEAR ULTIMATE STRESS (LT)
TENSILE ULTIMATE STRESS (LT)
0.65
0.60
0.55
0.50
0
0.5
1.0
1.5
THICKNESS, in.
Producer
A
B
C
ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
NEW KENSINGTON, PENNSYLVANIA
Ratios of Shear Properties
to
Tensile Properties (LT)
vs
Thickness
7178-T651 Al Alloy Plate
PLOTTED DATE APPROVED DATE

Fig. 21

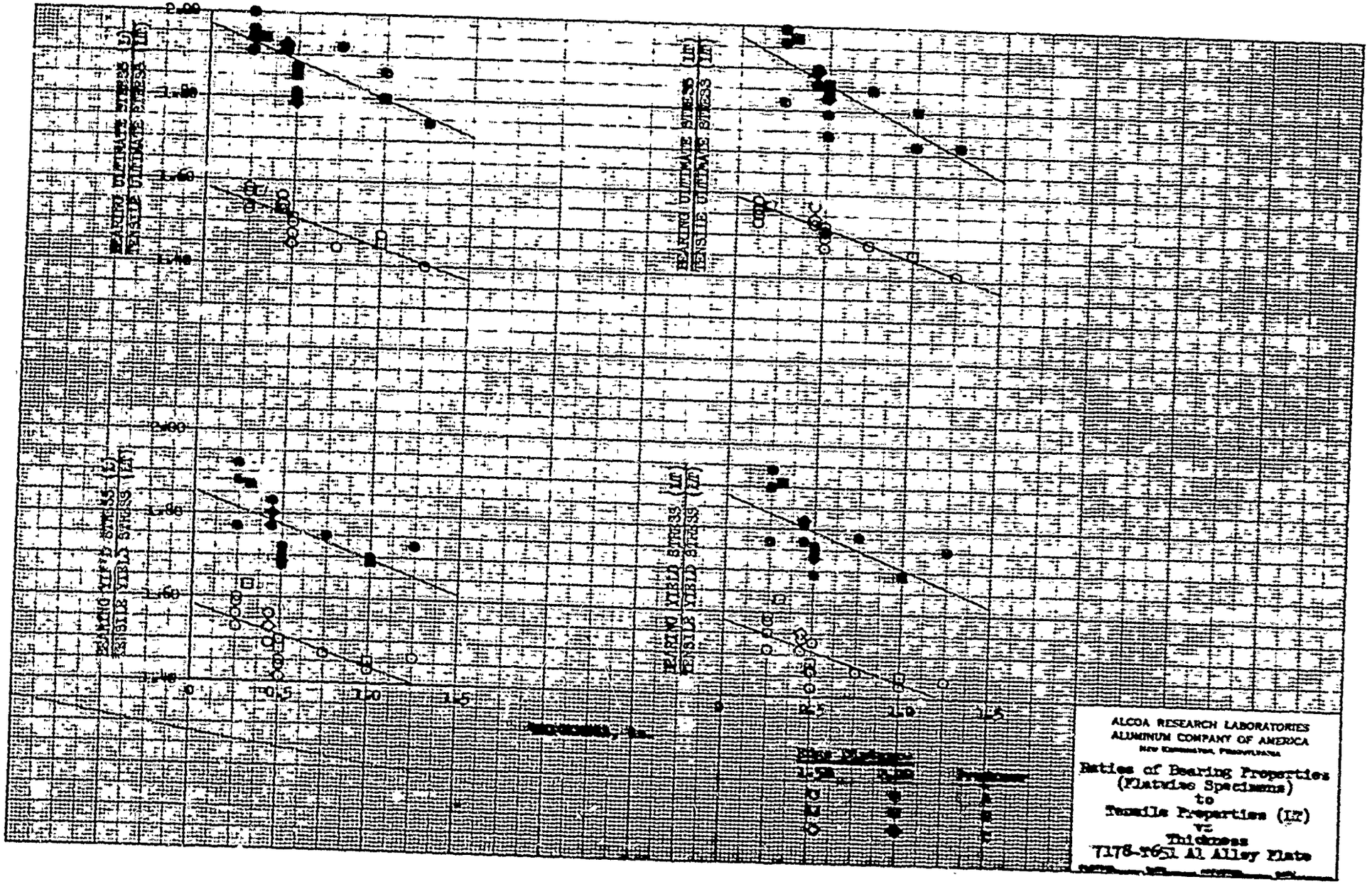

ALCOA RESEARCH LABORATORIES
ALUMINUM COMPANY OF AMERICA
Ratios of Bearing Properties
(Flatwise Specimens)
to
Tensile Properties (LT)
vs.
Thickness
7178-T651 Al Alloy Plate

Fig. 22

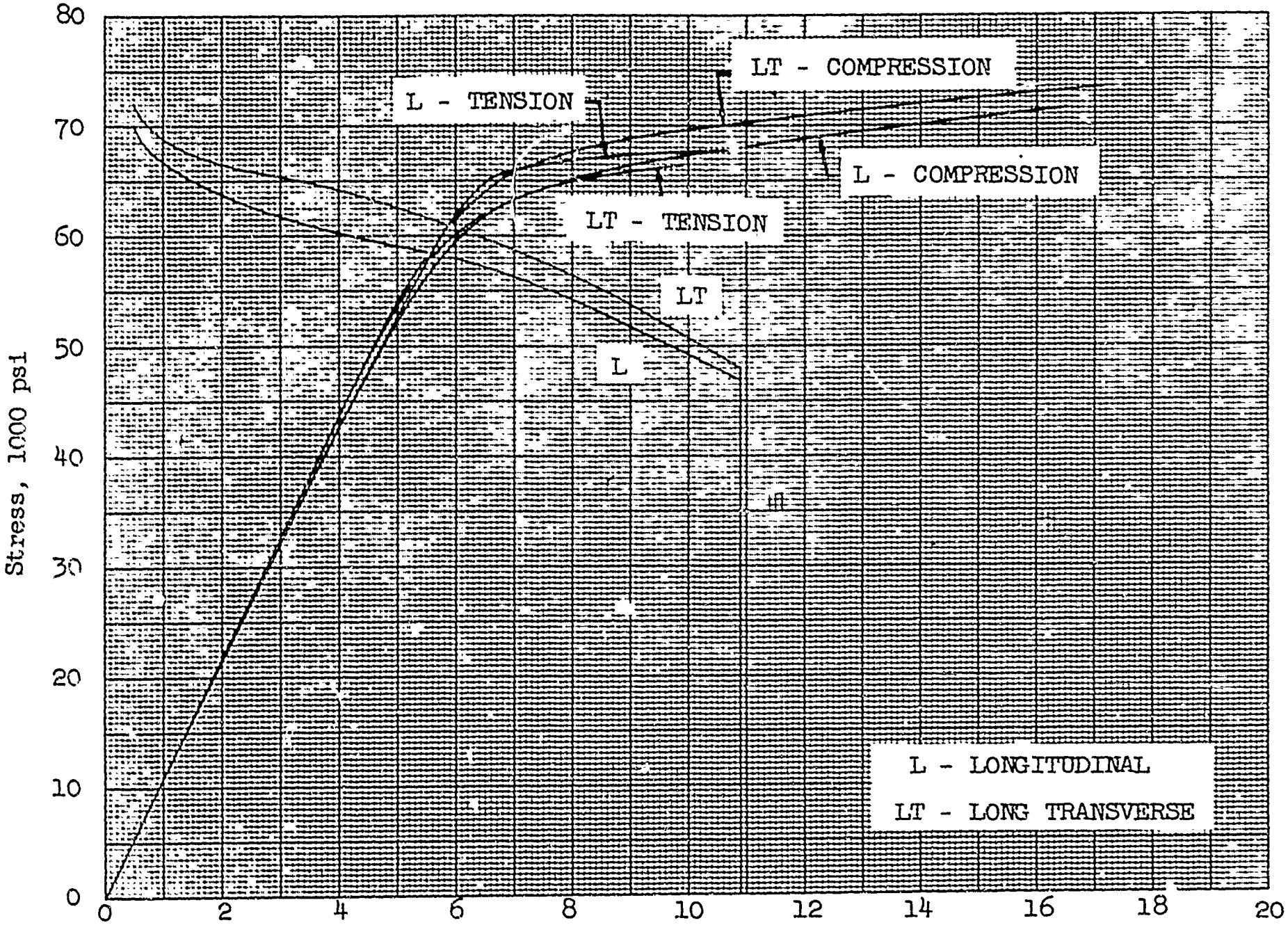


Fig. 23. Typical Stress-Strain and Tangent-Modulus Curves for 2014-T651 Aluminum Alloy Plate, 0.250-2.000-in.

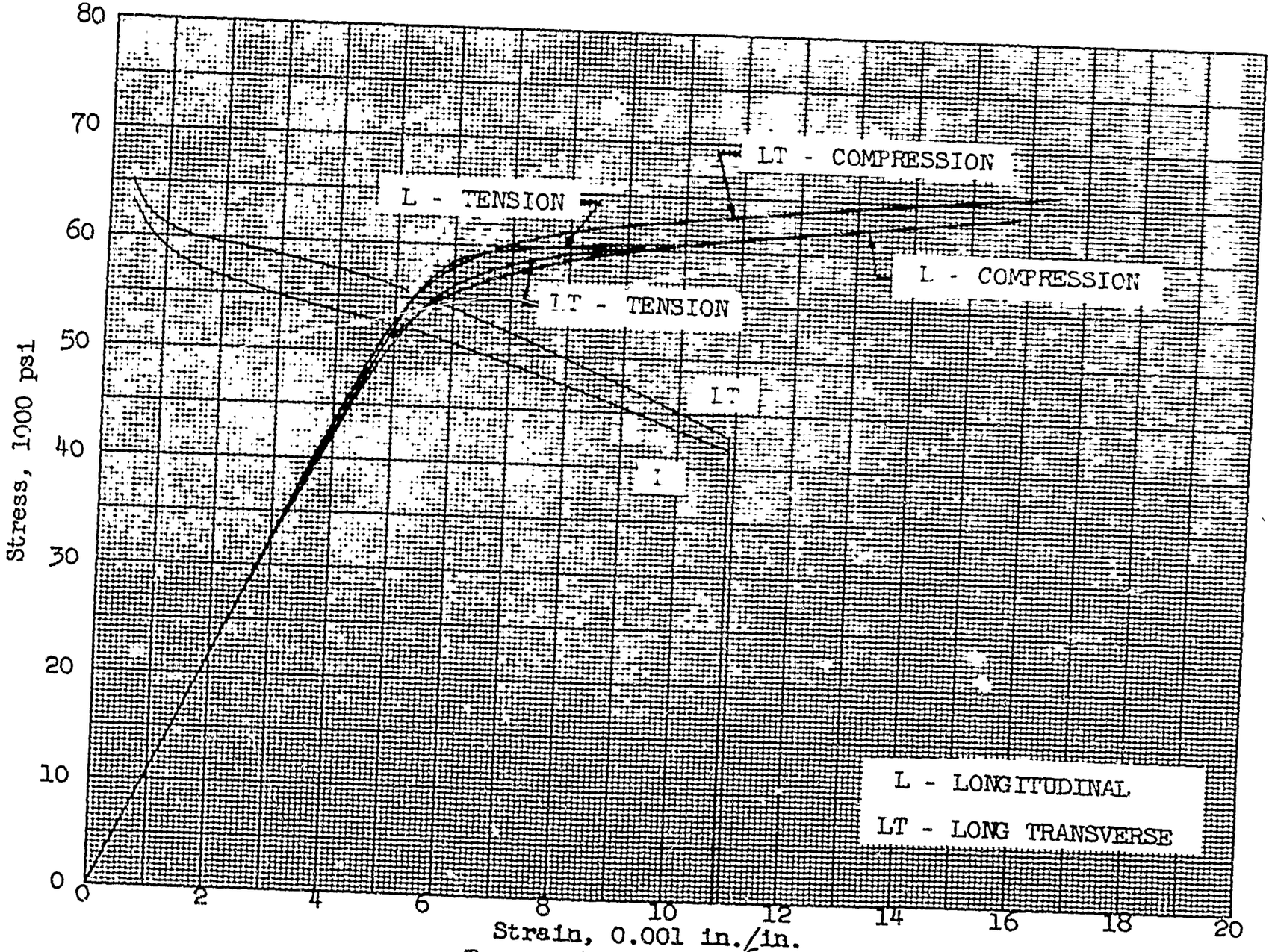


Fig. 24. Minimum ("A" Value) Stress-Strain and Tangent-Modulus Curves for 2014-T651 Aluminum Alloy Plate, 0.250-2.000-in.

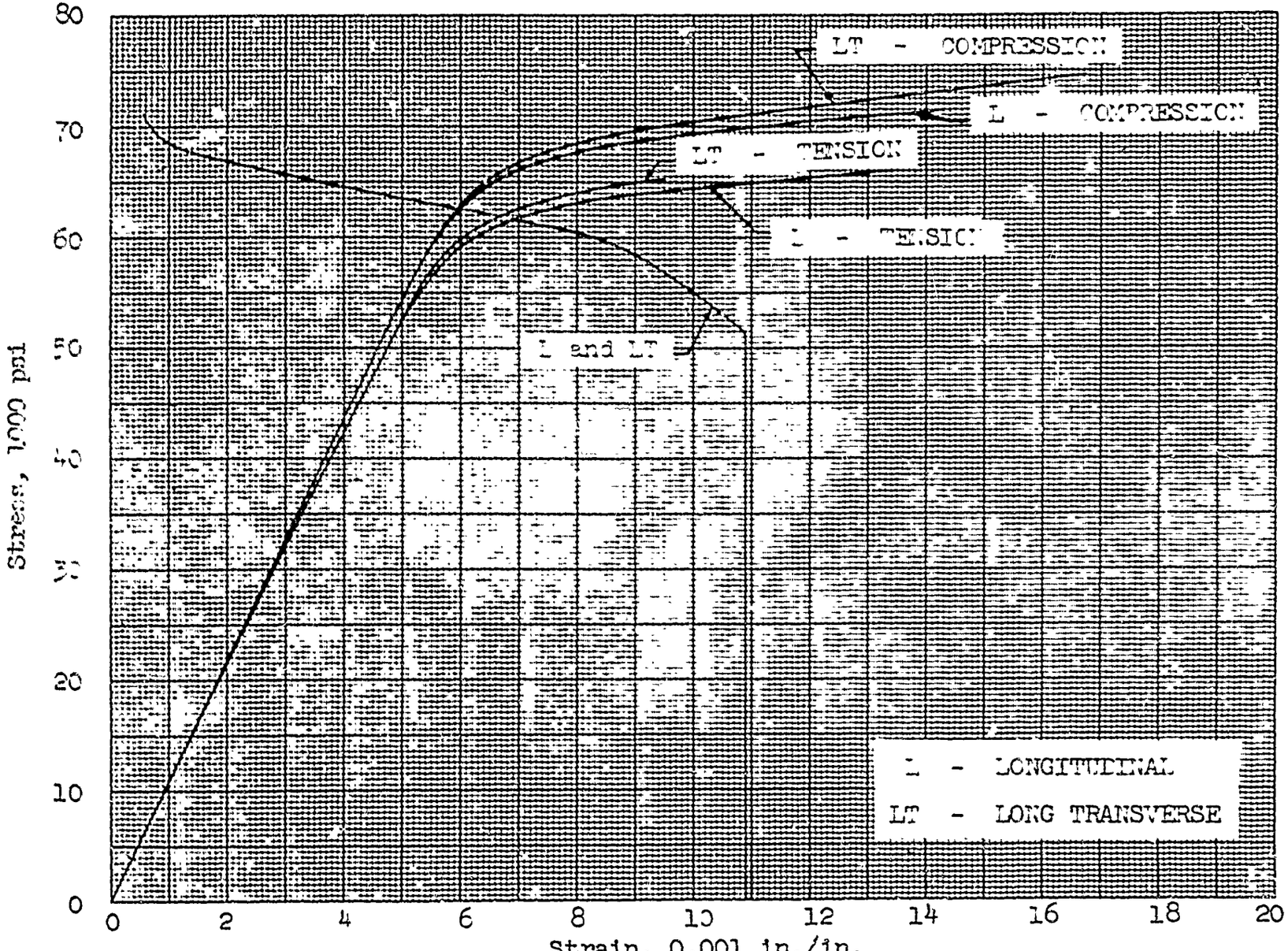


Fig. 25. Typical Stress-Strain and Tangent-Modulus Curves for 2014-T6 Aluminum Alloy Plate, 0.250-2.000-in. (Heat-Treated-By-User)

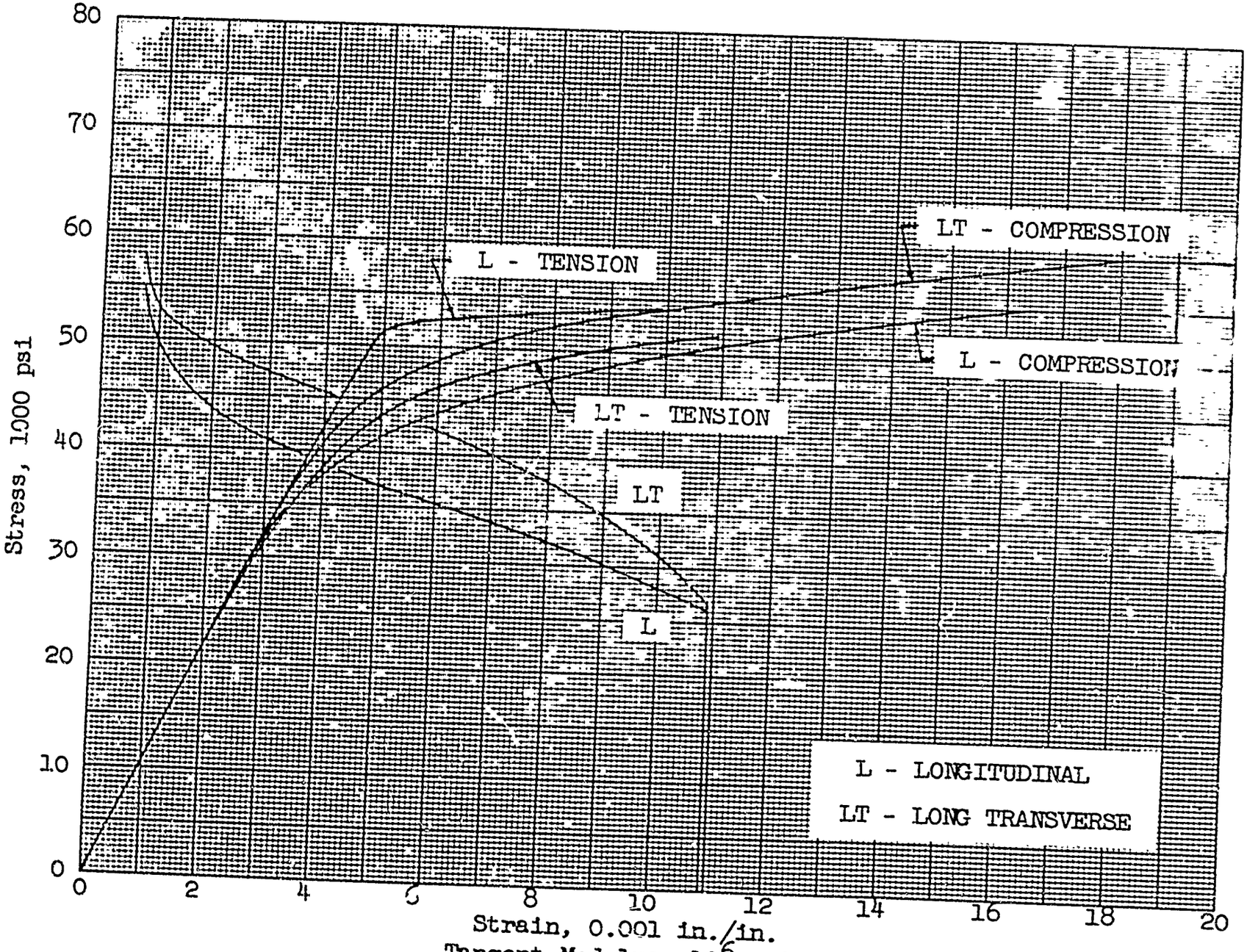


Fig. 26. Typical Stress-Strain and Tangent-Modulus Curves for 2024-T351 Aluminum Alloy Plate, 0.500-2.000-in.

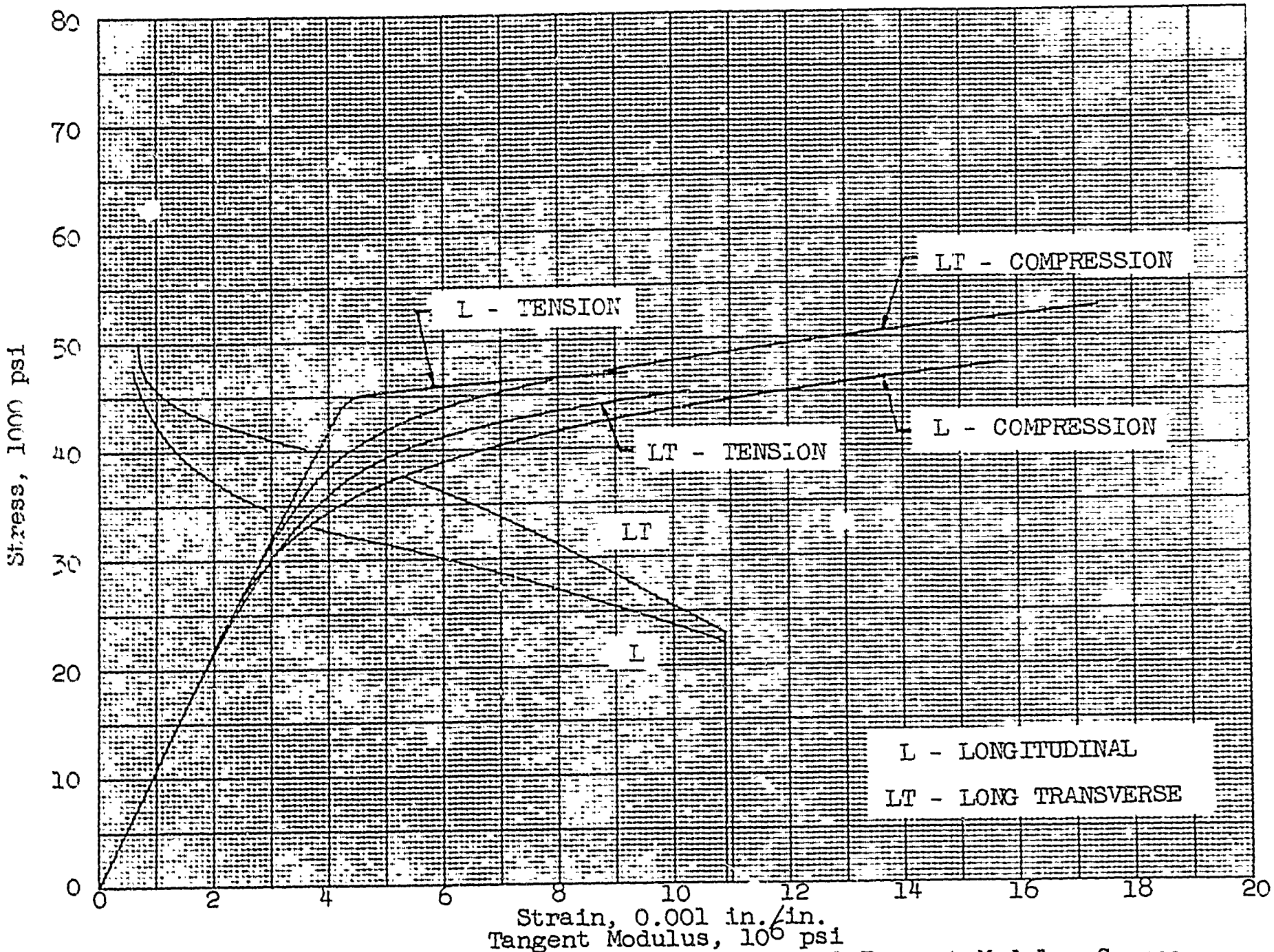


Fig. 27. Minimum ("A" Value) Stress-Strain and Tangent-Modulus Curves for 2024-T351 Aluminum Alloy Plate, 1.001-1.500-in.

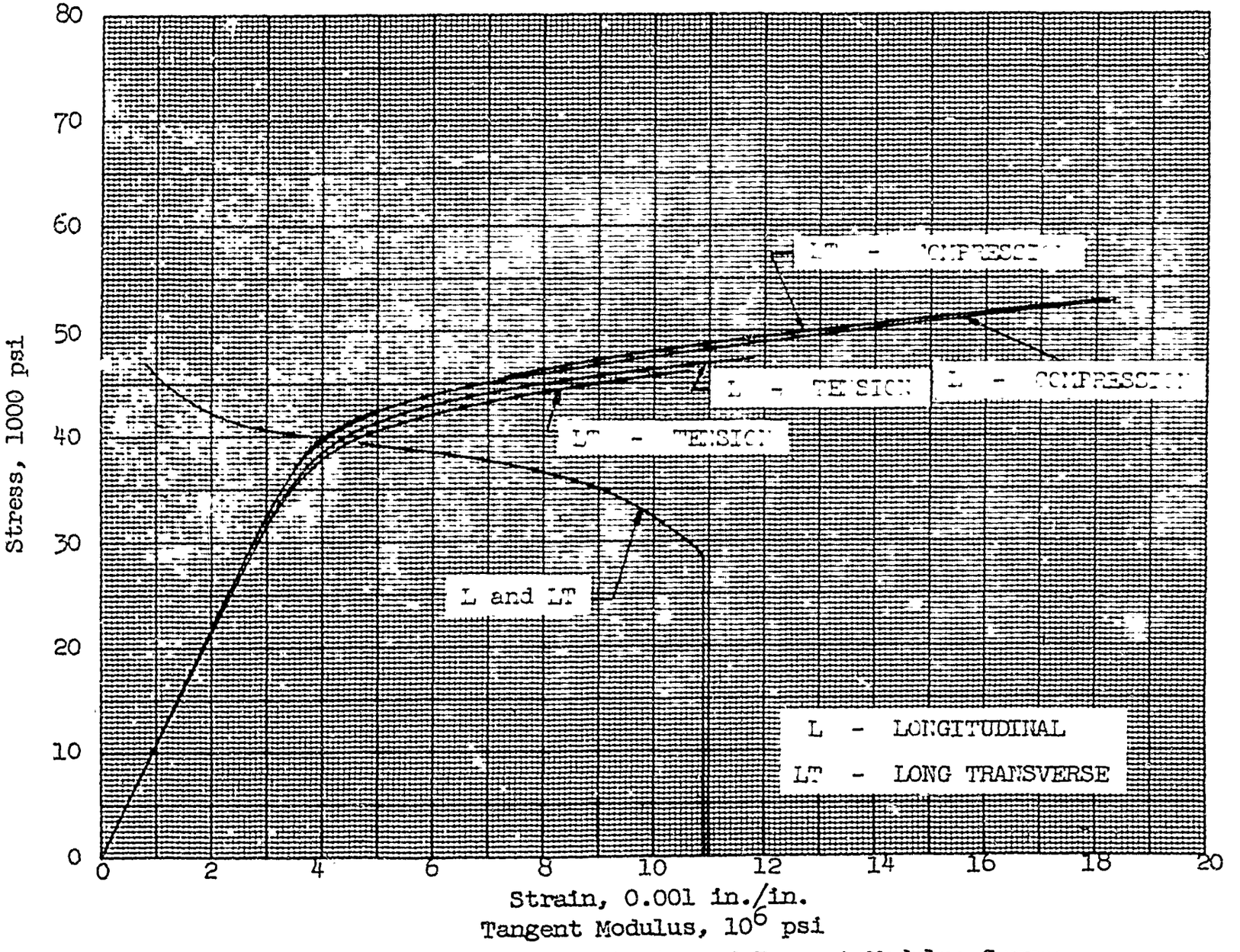


Fig. 30. Typical Stress-Strain and Tangent-Modulus Curves for 2024-T42 Aluminum Alloy Plate, 0.500-1.000-in. (Heat-Treated-By-User)

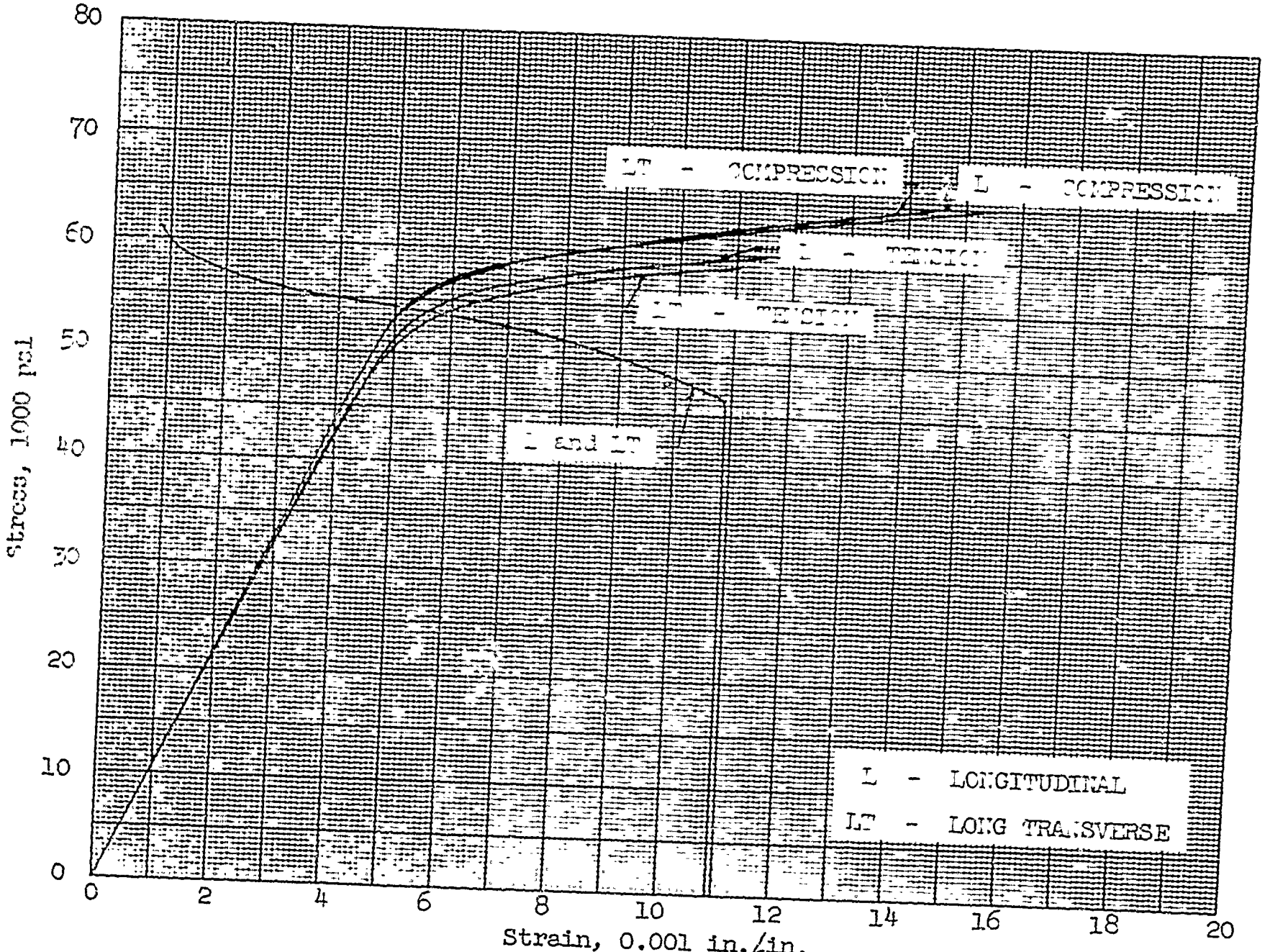


Fig. 31. Typical Stress-Strain and Tangent-Modulus Curves for 2024-T62 Aluminum Alloy Plate, 0.250-1.000-in. (Heat-Treated-By-User)

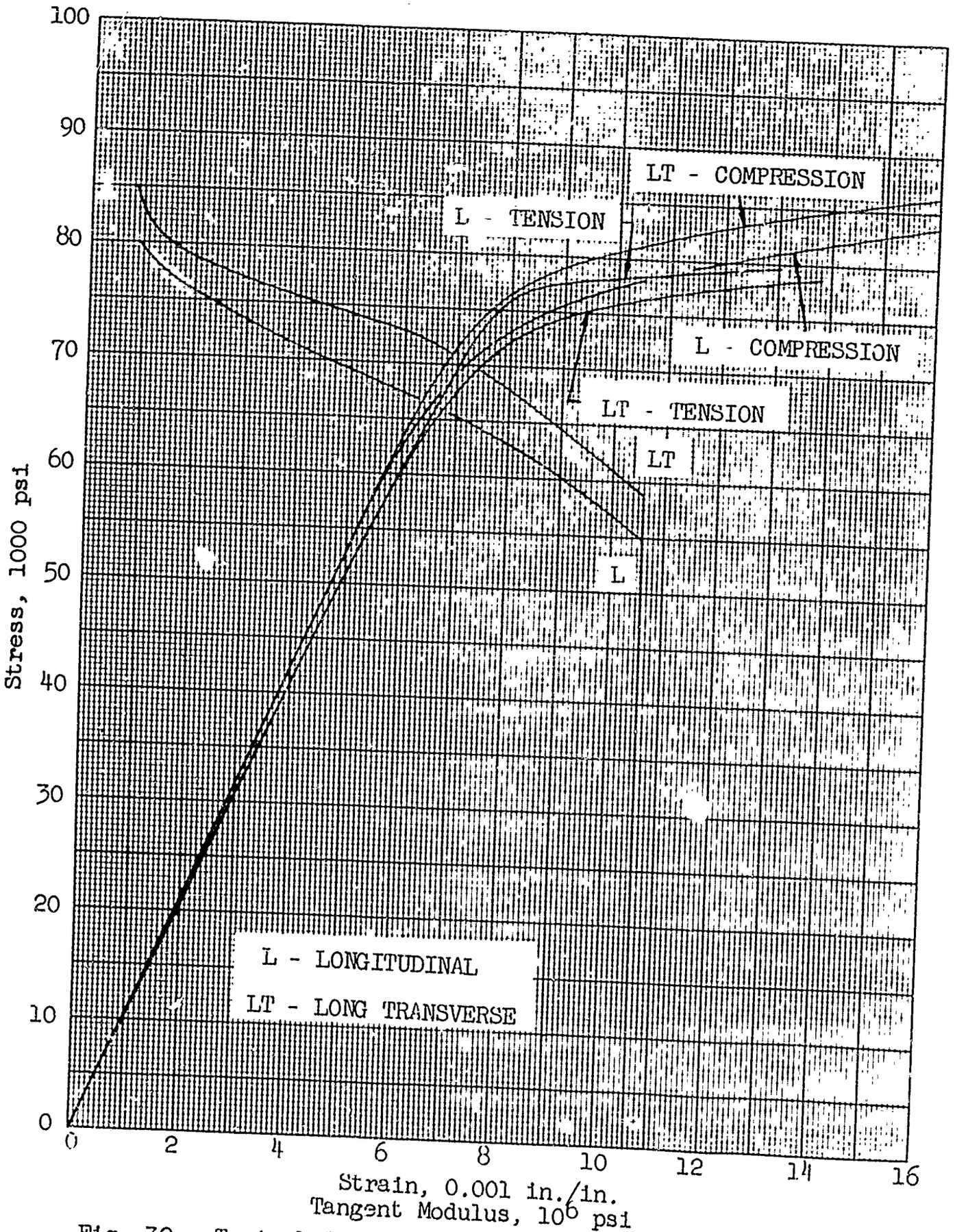


Fig. 32. Typical Stress-Strain and Tangent-Modulus Curves for 7075-T651 Aluminum Alloy Plate, 0.250-2.000-in.

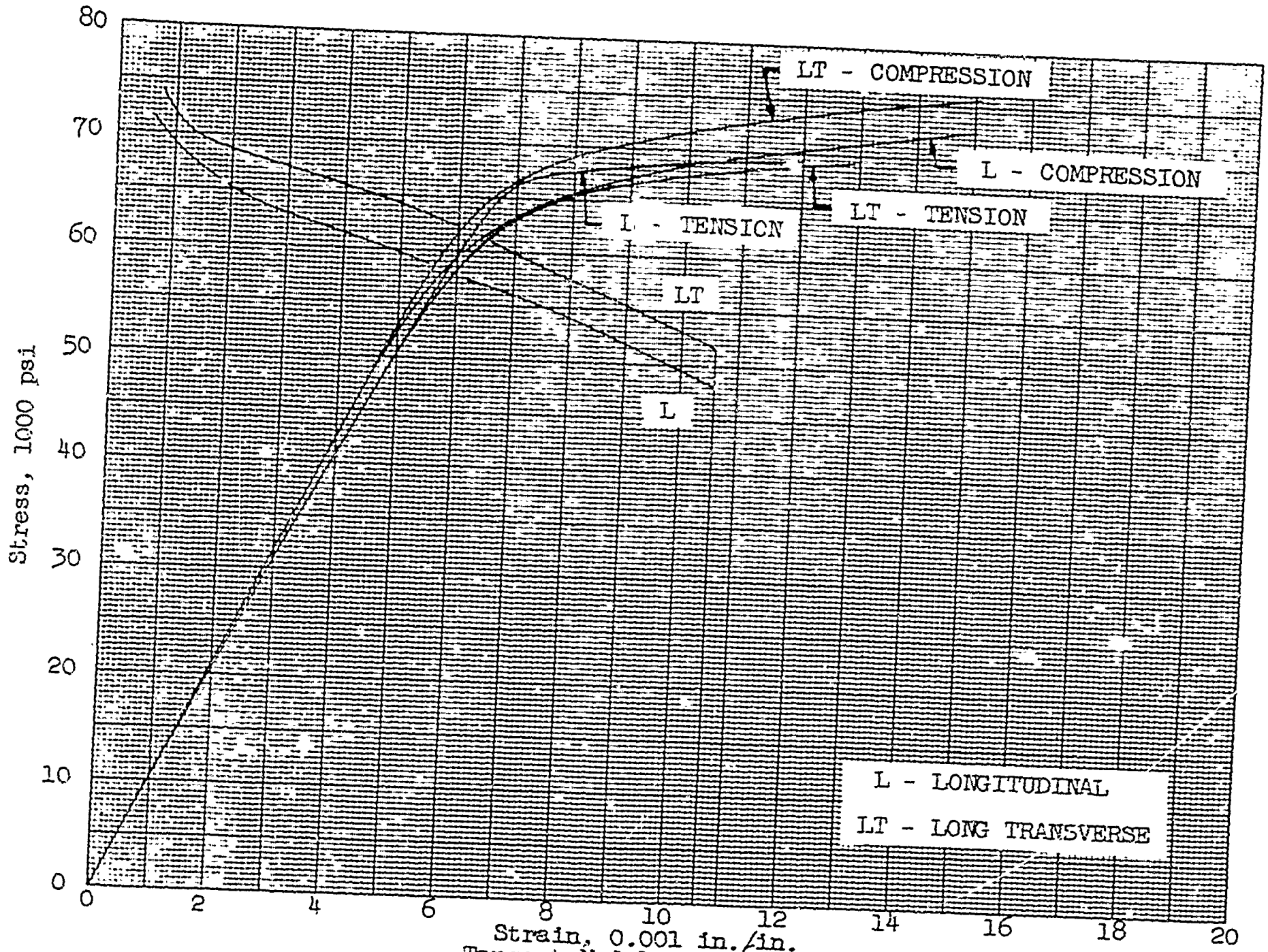


Fig. 33. Minimum ("A" Value) Stress-Strain and Tangent-Modulus Curves for 7075-T651 Aluminum Alloy Plate, 0.500-1.000-in.

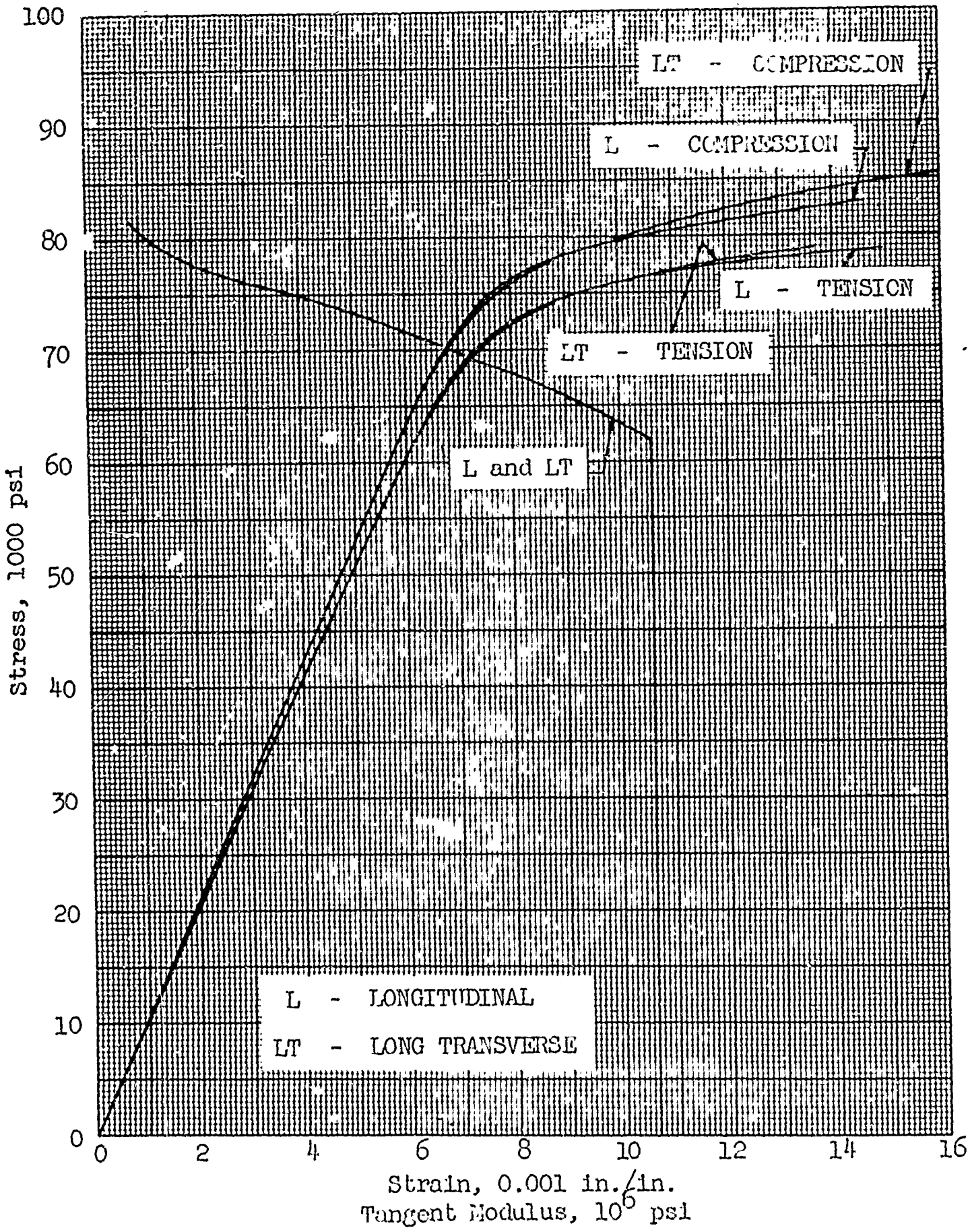


Fig. 34. Typical Stress-Strain and Tangent-Modulus Curves for 7075-T6 Aluminum Alloy Plate, 0.250-2.000-in. (Heat-Treated-By-User)

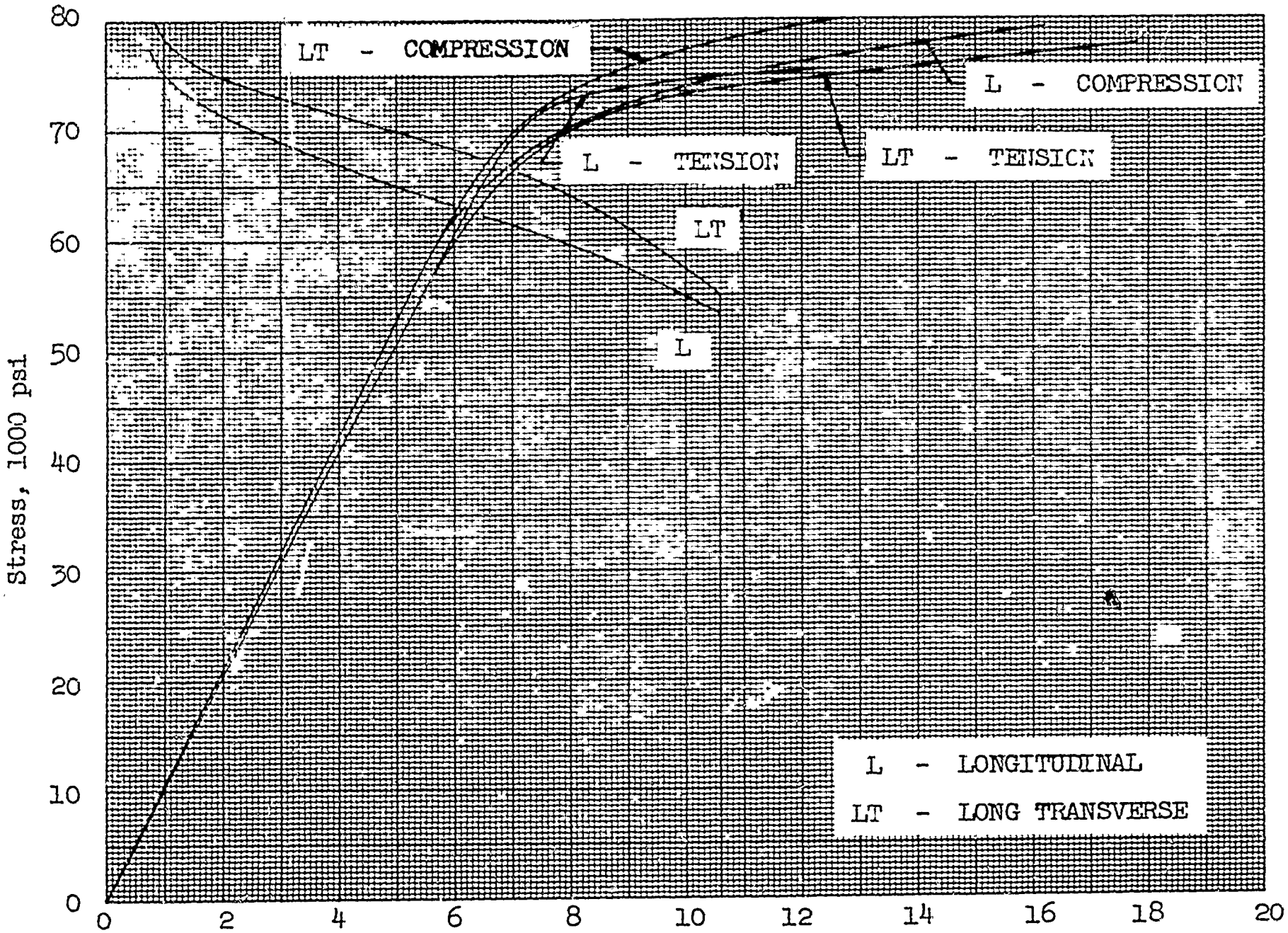


Fig. 35. Typical Stress-Strain and Tangent-Modulus Curves for 7079-T651 Aluminum Alloy Plate, 0.250-2.000-in.

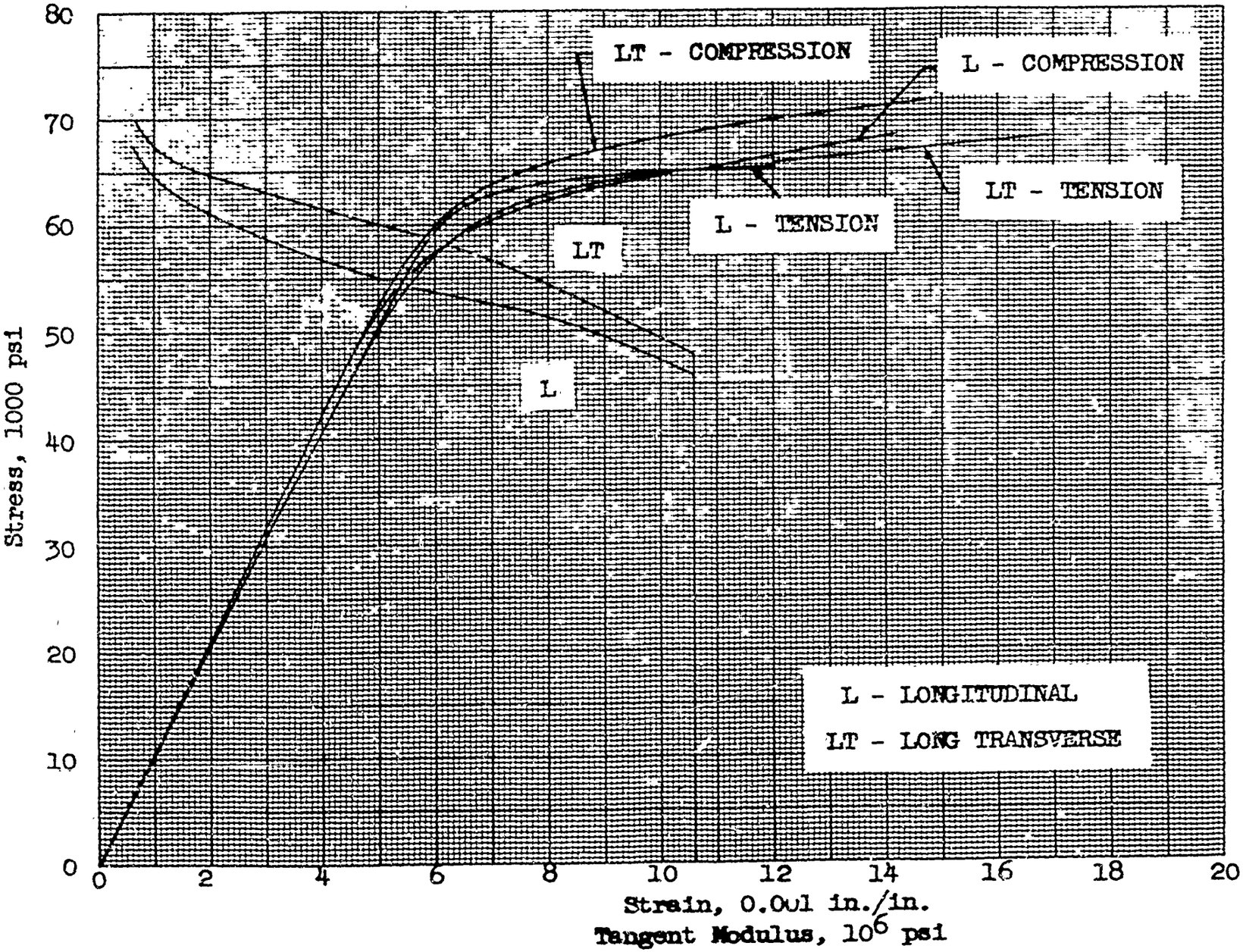


Fig. 36. Minimum ("A" Value) Stress-Strain and Tangent-Modulus Curves for 7079-T651 Aluminum Alloy Plate, 1.501-2.000-in.

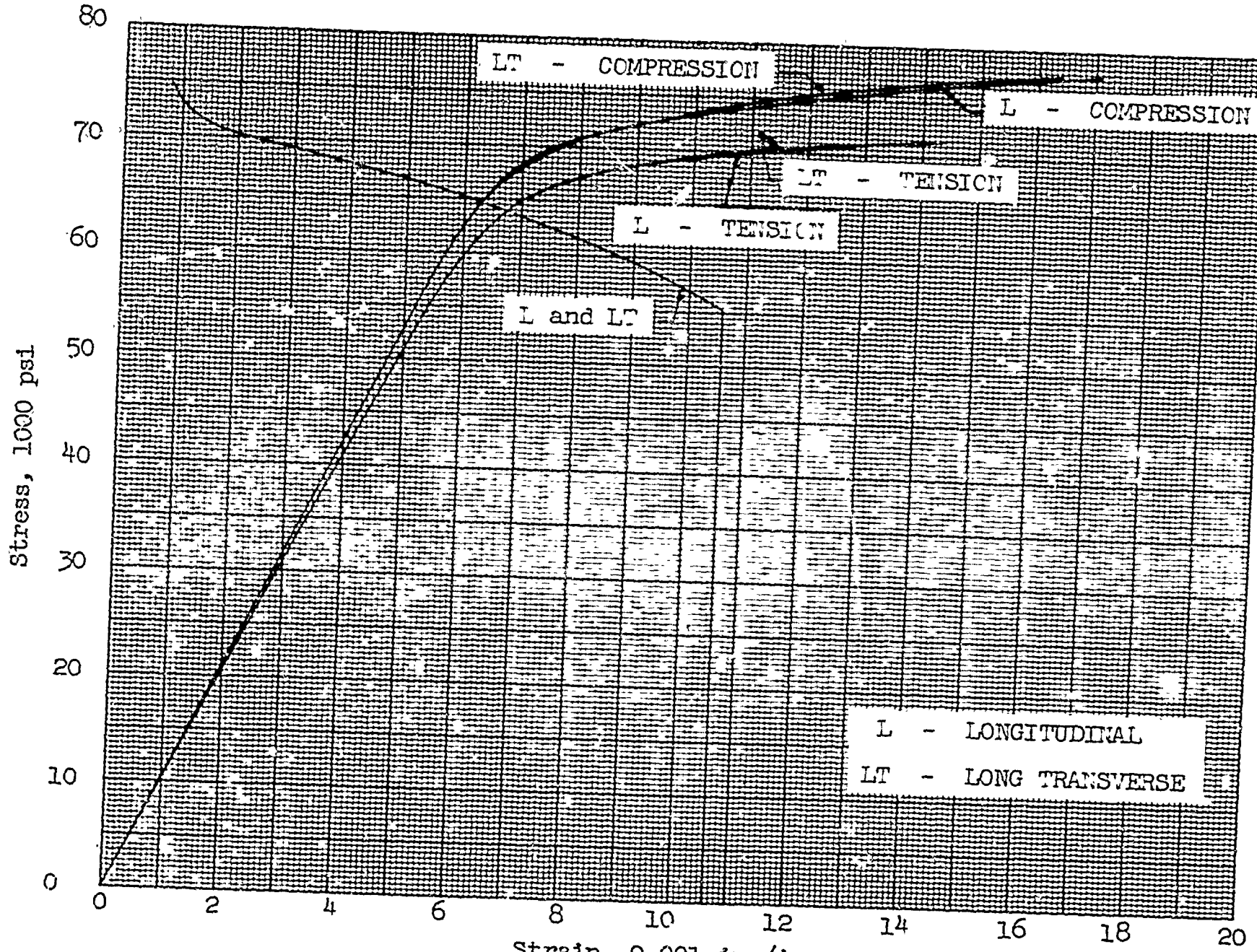


Fig. 57. Typical Stress-Strain and Tangent-Modulus Curves for 7079-T6 Aluminum Alloy Plate, 0.250-2.000-in. (Heat-Treated-By-User)

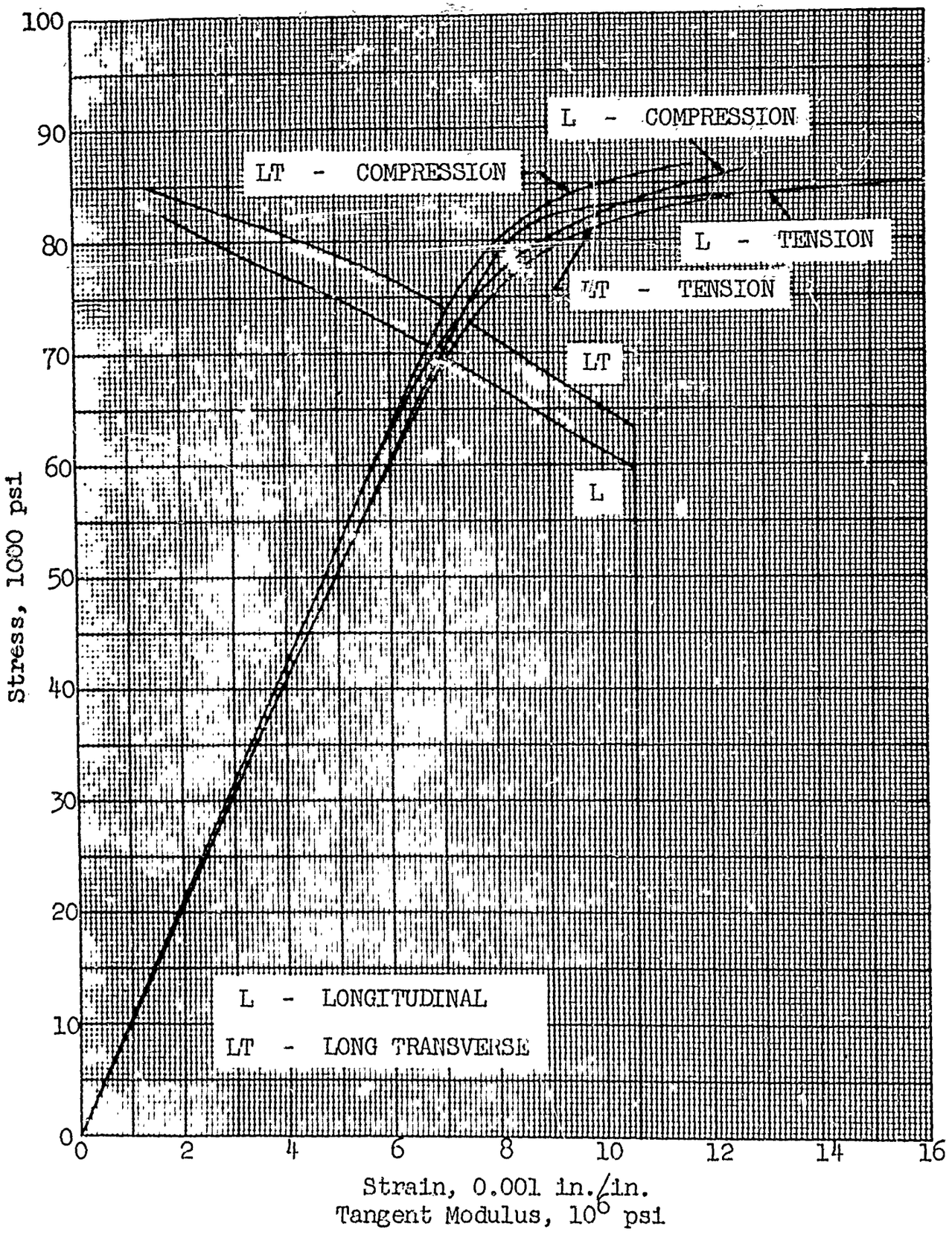


Fig. 38. Typical Stress-Strain and Tangent-Modulus Curves for 7178-T651 Aluminum Alloy Plate, 0.250-1.500-in.

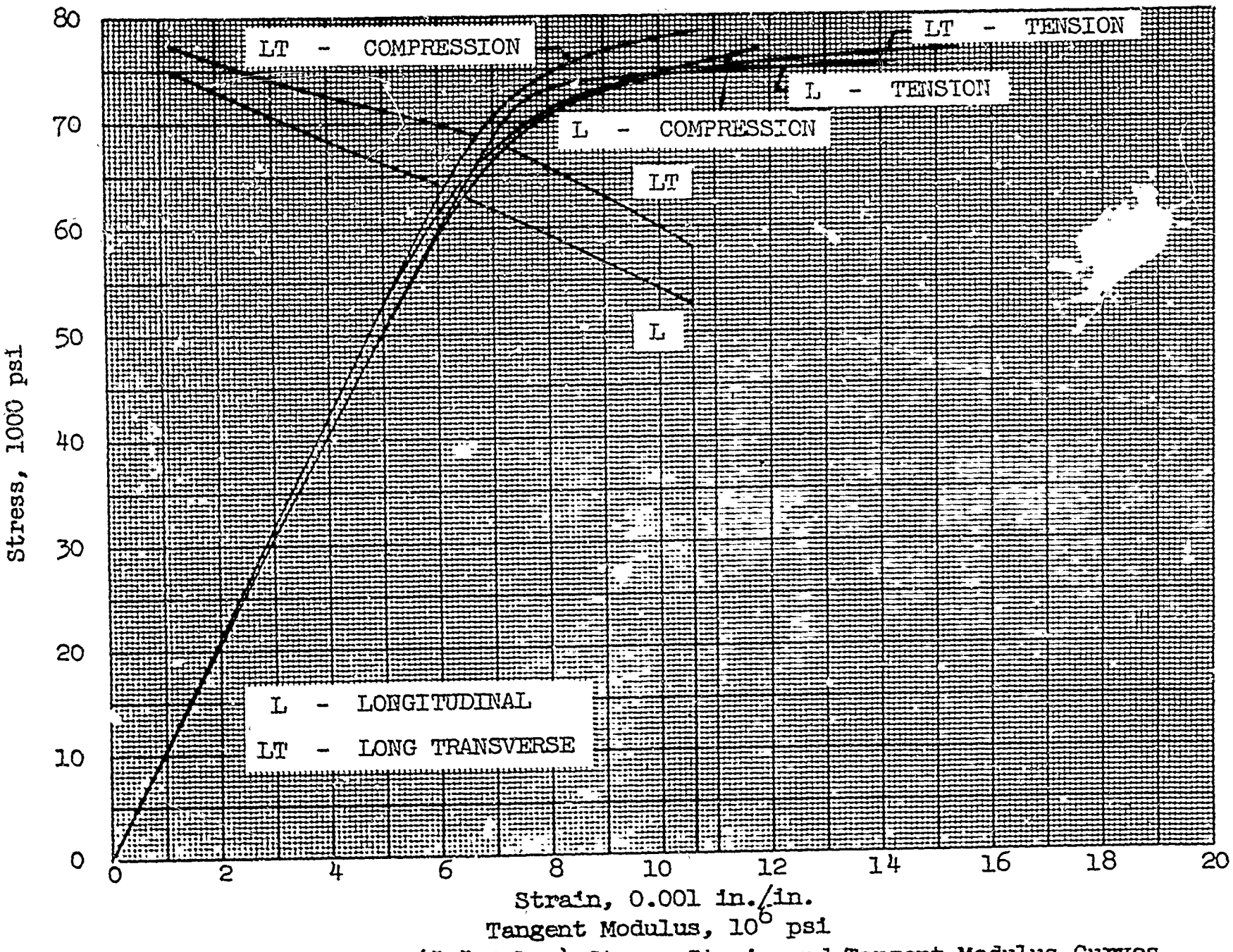


Fig. 39. Minimum ("A" Value) Stress-Strain and Tangent-Modulus Curves for 7178-T651 Aluminum Alloy Plate, 0.500-1.000-in.

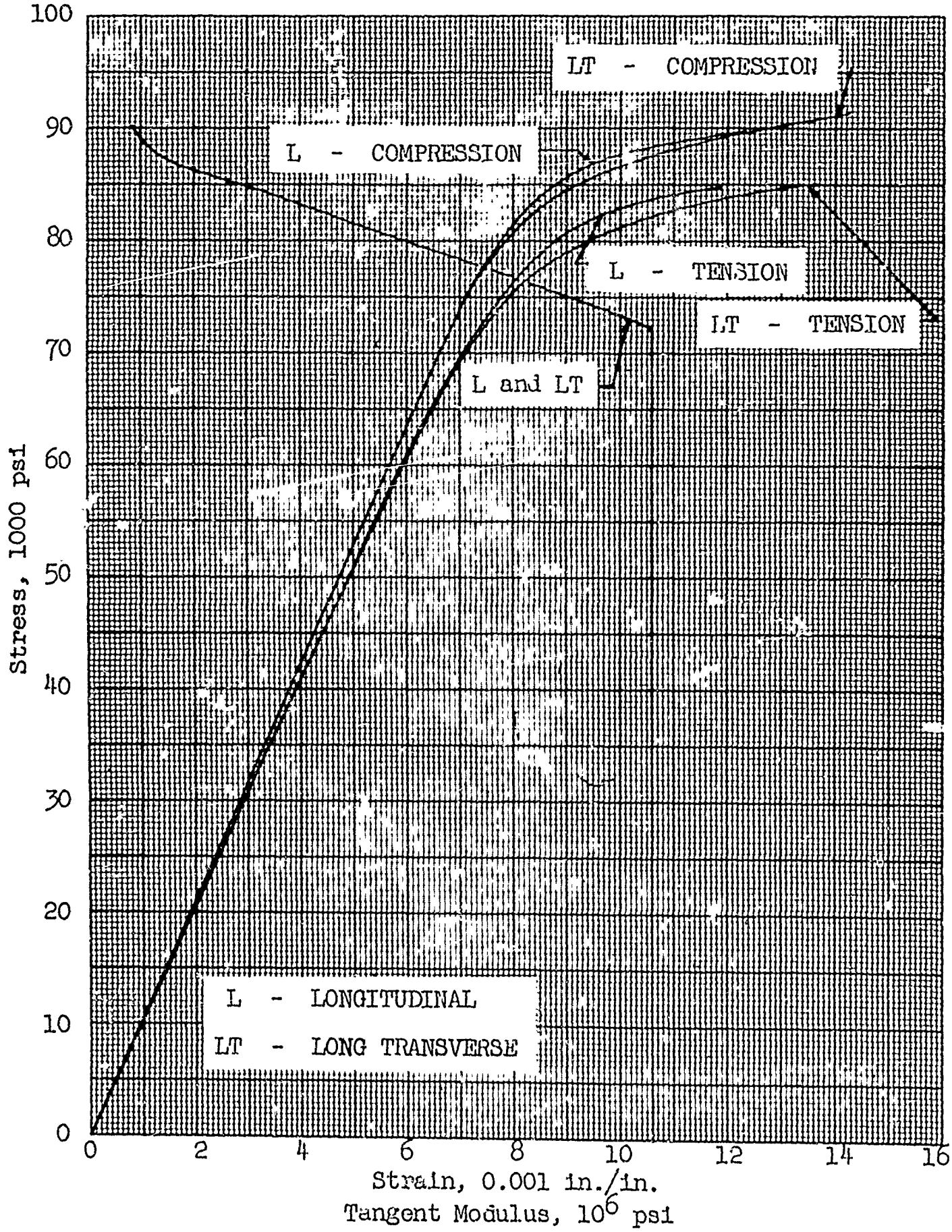


Fig. 40. Typical Stress-Strain and Tangent-Modulus Curves for 7178-T6 Aluminum Alloy Plate, 0.250-1.500-in. (Heat-Treated-By-User)