STRESSES

IN

STRUCTURAL STEEL ANGLES

WITH SPECIAL TABLES

BY

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PREFACE

Although steel angles are extensively used in structural framing, there are important factors affecting the stresses in such members that are not commonly considered in analyses which are made for purposes of design. This volume has been prepared in the hope that it may serve to indicate the nature of some of these factors, and that it may furnish the means for their consideration in practical problems.

On account of lack of symmetry of the section, the product of inertia is involved in the computation of bending stresses, but the ordinary structural handbooks do not include values of this element. The author has computed the values of the products of inertia for commercial angles 2 by 2 inches and larger, which values are included in Table I and Table II at the back of the book.

The section modulus polygon, which is a very useful device for studying and for determining the flexural stresses in unsymmetrical sections, is explained, and for commercial angles 2 by 2 inches and larger coordinates for the vertices of the polygons are given in Table III.

The subject of end connections and their efficiency is considered, and in Table IV and Table V are given a considerable number of values of efficiency, of equivalent effective area, and of total tension allowable for a maximum unit stress of 16,000 pounds per square inch, computed in accordance with the method which is outlined in the text.

L. A. W.

Tucson, Arizona,
January 1, 1917.

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STRESSES IN STRUCTURAL STEEL ANGLES

THEORY AND DISCUSSION

Art. 1. Relation between Bending Moment and Flexural Stress *

FOR a symmetrical section, with the plane of loading coincident with one of the principal axes of the section, the relation between the bending moment and the bending stress at an extreme fiber is

$$f=\frac{My}{I}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

in which f = unit stress at the extreme fiber, due to bending;
M = bending moment at the section under consideration;
I = moment of inertia of the section;
y = distance from extreme fiber to a line through the center of gravity of the section, the line being taken coincident with or parallel to the neutral axis of the section.

The value of $\frac{I}{y}$ is a constant for any given section and is ordinarily called the section modulus or section factor. If

* For an excellent treatment of this subject, see "An Analysis of General Flexure in a Straight Bar of Uniform Cross Section," by Professor L. J. Johnson, Trans. Am. Soc. C. E., Vol. LVI, p. 169, 1906.

the letter s is used to designate the section modulus, Eq. (1) becomes

$$f=\frac{M}{s}. \qquad (2)$$

If $\frac{I}{y}$ is retained as the value of the section modulus, Eq. (2) will be applicable only for those conditions which obtained for Eq. (1), viz., for symmetrical sections, with the planes of loading coincident with principal axes of the sections considered. However, a more general value of the section modulus can be derived, which, if used in Eq. (2), as the value of s, will make this equation applicable to any section, whether symmetrical or unsymmetrical, and for a plane of loading extending in any direction from the center of gravity of the section. The term section modulus, unless otherwise specifically stated, will be used to designate the general value, and for any case of pure flexure the extreme fiber stress will then be equal to the bending moment at the section divided by the section modulus.

Art. 2. Expressions for the Section Modulus

For any given section subject to bending stresses, let the rectangular axes of reference, X–X and Y–Y, be taken with their origin at O, the center of gravity of the section, as indicated in Fig. 1. Let OP be the plane of loading and nn the neutral axis. (It is frequently assumed that the neutral axis is perpendicular to the plane of loading, but this is not true for the general case.) Then the general expression for the section modulus is

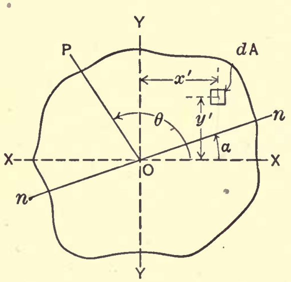


Fig. 1.

$$s=\frac{I_xI_y-J^2}{(I_y \sin\theta-J\cos\theta)y+(I_x\cos\theta-J\sin\theta)x'}, \qquad (3)$$

in which s = section modulus of the section for the particular plane of loading;
I_x = moment of inertia of the section about X–X;
I_y = moment of inertia of the section about Y–Y;
J = product of inertia of the section for axes X–X, Y–Y;
x, y = coordinates of the extreme fiber;
θ = angle from OX to OP (see Fig. 1).

For certain special cases Eq. (3) can be simplified. Thus, *for any section which is symmetrical about either axis*, J becomes zero, and the expression for the section modulus becomes

$$s=\frac{I_x I_y}{I_y \sin\theta\cdot y+I_x\cos\theta\cdot x}. \qquad (4)$$

For a *symmetrical section for which the plane of loading coincides with* Y–Y, θ becomes 90 degrees and the expression for the section modulus becomes

$$s=\frac{I_x}{y}. \qquad (5)$$

For a *symmetrical section for which the plane of loading coincides with* X–X, θ becomes zero and the expression for the section modulus becomes

$$s=\frac{I_y}{x}. \qquad (6)$$

In order to derive the expression for the section modulus which is given in Eq. (3), let the section be indicated by Fig. 1, x', y' being the coordinates of any infinitesimal area (dA), and α being the angle which the neutral axis (nn) makes with X–X. M is the bending moment for which the plane of action is OP, and the other quantities are as defined under Eq. (3).

For a combination of bending and direct stress the neutral axis will not pass through the center of gravity of the section, but since the resultant stress can in this case be obtained by combining the stresses obtained for pure flexure and for axial loading, the derivation of the section modulus will be made for the case of pure flexure, for which the neutral axis will pass through the center of gravity.

For any point for which the coordinates are x', y', the distance of the point from the neutral axis is $(y' \cos \alpha - x' \sin \alpha)$. Therefore, if the stress is proportional to the distance from the neutral axis,

$$\frac{f'}{f} = \frac{y' \cos \alpha - x' \sin \alpha}{y \cos \alpha - x \sin \alpha}, \quad . \quad . \quad . \quad . \quad . \quad (7)$$

in which f' = unit stress at the point for which the coordinates are x', y';

f = unit stress at a point for which the coordinates are x, y, or since x, y, are the coordinates the extreme fiber, f is the extreme fiber stress.

The bending moment may be resolved into two components, one of which acts in the plane of OY and the other in the plane of OX. Also, for equilibrium, the component of the moment which acts in the plane of OY must be equal to the sum of the moments of the stresses about the axis X–X, and the component of the moment in the plane of OX must be equal to the sum of the moments of the stresses about the axis Y–Y, or using for any stress the value of f' obtained from Eq. (7),

$$\begin{aligned} M \sin \theta &= \int f' y' dA \\ &= \frac{f}{y \cos \alpha - x \sin \alpha} \int y'(y' \cos \alpha - x' \sin \alpha) dA, \quad . \quad (8) \end{aligned}$$

and

$$\begin{aligned} M \cos \theta &= \int f' x' dA \\ &= \frac{f}{y \cos \alpha - x \sin \alpha} \int x'(y' \cos \alpha - x' \sin \alpha) dA. \quad . \quad (9) \end{aligned}$$

Eqs. (8) and (9) may be simplified by substituting for $\int (y')^2 dA$ its equivalent I_x, for $\int (x')^2 dA$, its equivalent I_y, and for $\int x'y'dA$ its equivalent J. Then, by equating the value of f obtained from Eq. (8) to the value obtained from Eq. (9),

$$\frac{\sin\theta}{I_x \cos\alpha - J\sin\alpha} = \frac{\cos\theta}{J\cos\alpha - I_y \sin\alpha}, \quad . \quad . \quad (10)$$

from which

$$\tan\alpha = \frac{I_x - J\tan\theta}{J - I_y \tan\theta}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

By substituting the value of $\tan\alpha$ in Eq. (9), solving for $\frac{M}{f}$ and by substituting for $\frac{M}{f}$ its equivalent s, the value obtained for the section modulus is that which is given in Eq. (3).

Art. 3. Product of Inertia

The product of inertia (J), which is involved in the general equation for the section modulus, may be defined by the mathematical expression,

$$J = \int x'y'dA, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

in which x', y', are the coordinates of any infinitesimal area (dA).

Also

$$J = J_{cg} + Akh, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

in which J = product of inertia for any given rectangular axes;

J_{cg} = product of inertia for parallel axes through the center of gravity;

A = area of the section;

k, h = coordinates of the center of gravity with reference to the given axes for which J is desired.

For any symmetrical section J_{cg} is zero, or for such a section J becomes Akh.

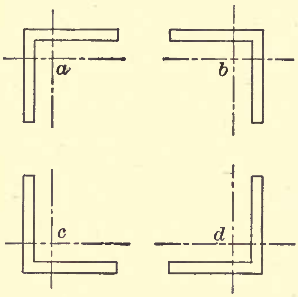


FIG. 2.

The product of inertia may be either a positive or a negative quantity. For an angle the value of J will be positive for axes taken as shown at a and d of Fig. 2, and the value will be negative for axes, as shown at b and c of the same figure.

The numerical values of J for structural steel angles are given in the tables at the back of the book, to which the proper sign must be applied for each particular case.

Art. 4. Section Modulus Polygons

If, for any given section, the values of the section modulus are computed for values of θ from 0 to 360 degrees, and if

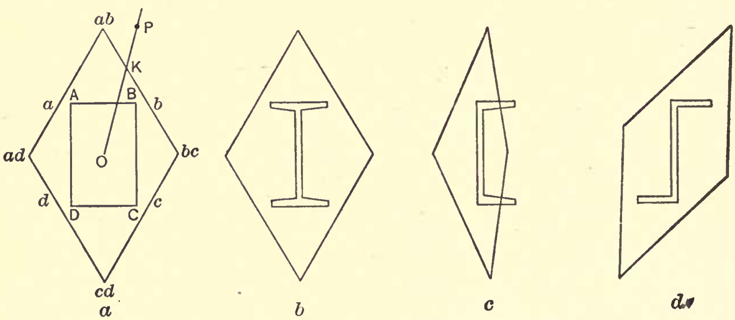


FIG. 3.—Types of Section Modulus Polygons.

these values are plotted as radii vectors, the outline of the resulting figure will be a polygon, having a side for each salient angle of the polygon which bounds the section. For some common sections the general forms of the corresponding section modulus polygons are indicated in Fig. 3.

Having the section modulus polygon for a given section, the value of the section modulus may be obtained by scaling the radius vector corresponding to the plane of loading. For example, for the rectangular section indicated at *a* of Fig. 3, the vector *OK* is the graphical representation of the section modulus for the plane of loading *OP*, and the bending stress at the vertex *B* is obtained by dividing the bending moment by this value of the section modulus. It will be observed that by using the section modulus polygon, not only is the required section modulus readily obtained, but also, the lines of the polygon which are intersected by the line of direction of *OP* indicate the points of the section at which the critical bending stresses will occur.

In order to plot the section modulus polygon for a particular section, the coordinates of each vertex of the polygon may be determined, and the polygon can then be drawn by connecting each two successive vertices with a straight line. If x_a, y_a are the coordinates of *a* and x_b, y_b, the coordinates of *b*, two successive vertices of the polygon which bounds the section, the coordinates x_{ab}, y_{ab} of the vertex of the section modulus polygon corresponding to the side *ab* of the section will be,

$$x_{ab}=\frac{(x_a-x_b)J-(y_a-y_b)I_y}{x_ay_b-x_by_a}, \quad . \quad . \quad . \quad . \quad (14)$$

$$y_{ab}=\frac{(x_a-x_b)I_x-(y_a-y_b)J}{x_ay_b-x_by_a}, \quad . \quad . \quad . \quad . \quad (15)$$

If *ab* is parallel to *X–X*,

$$x_{ab}=\frac{J}{y_a}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (16)$$

$$y_{ab}=\frac{I_x}{y_a}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (17)$$

If ab is parallel to $Y-Y$.

$$x_{ab} = \frac{I_y}{x_a}, \quad \ldots \ldots \quad (18)$$

$$y_{ab} = \frac{J}{x_a}. \quad \ldots \ldots \quad (19)$$

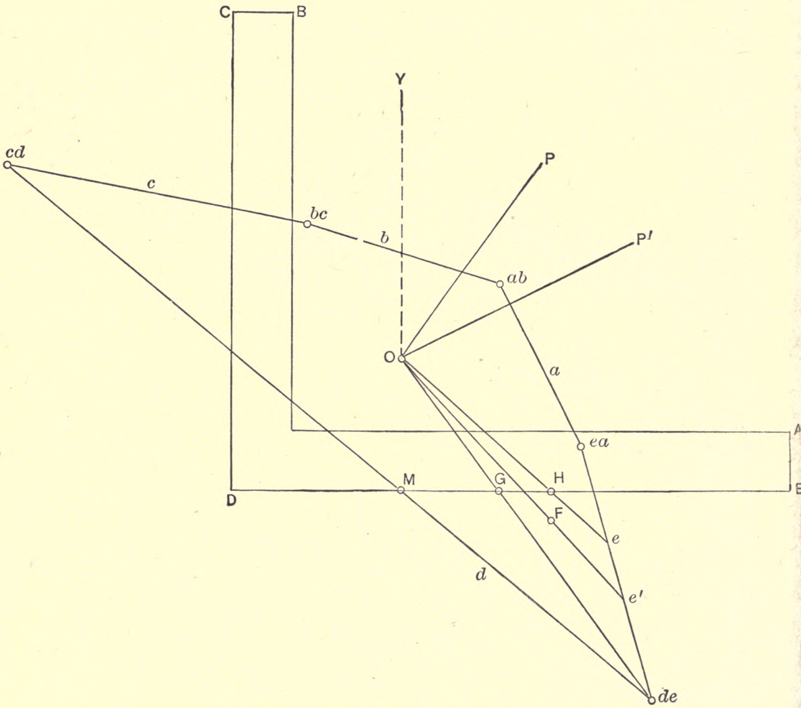


Fig. 4.

An inspection of Eqs. (14) to (19) will show that for many cases the vertices of the section modulus polygon can be easily located, since the values of $\frac{I}{y}$ and $\frac{I}{x}$ can be obtained from handbooks, for structural sections, and since J is zero for symmetrical sections, which includes I-beams, channels, and tees. For angles, Eqs. (14) and (15) may be used, but in order that the users of this book may avoid this labor, the coordinates have been computed and are tabulated at the back of the book for the commercial sizes of steel angles, and for variations in thickness of $\frac{1}{8}$ inch. For thicknesses in odd numbers of sixteenths of an inch, the values of the coordinates may be obtained by interpolation.

A typical section modulus polygon for an angle is shown in Fig. 4. If OP represents the direction of the plane of loading, the two points at which critical stresses will occur are b and d of the angle, but if the plane of loading is shifted to OP' the points of critical stresses will be a and d.

The most advantageous plane of loading is that for which there is the greatest section modulus. For an angle used as a purlin, for a vertical load, a study of Fig. 4 will show that the purlin should be set as indicated at a of Fig. 5, *not* as shown at b.

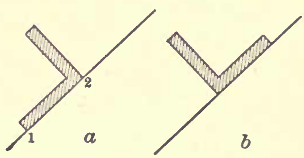


FIG. 5.

It will be observed that for an angle in tension or compression, the application of the load at the gauge line is not far from the most advantageous point of loading.

Art. 5. Neutral Axis

For pure flexure the neutral axis will pass through the center of gravity of the section, assuming some direction, as for example nn (Fig. 1), which direction will depend upon the plane of loading and upon the section, but the neutral axis will not necessarily be perpendicular to the plane of loading.

In Art. 2, the relation of α to θ (see Eq. 11), was obtained in the derivation of the expression for the section modulus.

This equation and two of its equivalent forms are:

$$\tan\alpha=\frac{I_x-J\tan\theta}{J-I_y\tan\theta}, \quad \ldots \ldots \quad (20)$$

$$\tan\alpha=\frac{I_x\cot\theta-J}{J\cot\theta-I_y}, \quad \ldots \ldots \quad (21)$$

$$\tan\alpha=\frac{I_x\cos\theta-J\sin\theta}{J\cos\theta-I_y\sin\theta}. \quad \ldots \quad (22)$$

For a combination of flexure and direct loading the neutral axis will not pass through the center of gravity of the section, but it will be parallel to the position which it would have for pure flexure, and the distance between the two parallel lines will be,

$$v=\frac{F}{A}\,\frac{(y\cos\alpha-x\sin\alpha)}{f}, \quad \ldots \quad (23)$$

in which v = distance from the neutral axis to the center of gravity;
F = total stress acting normal to the section;
A = area of the section;
f = unit stress at the extreme fiber due to flexure;
x, y = coordinates of the extreme fiber;
α = angle which the neutral axis makes with X–X.

By the use of Eqs. (20) to (23) the position and the direction of the neutral axis can be determined, but by the use of the section modulus polygon these computations can usually be avoided for practical problems. For example, consider an I-beam, as indicated in Fig. 6. For a loading in the plane OP, the section modulus is represented by the line from O to the vertex ab. Had the plane of loading intersected the sides a and c of the polygon, the critical stresses would have been at A and C of the beam, and had the plane of loading intersected the sides b and d of the polygon, the points of critical stress would have been B and D, but since the plane of loading passes through the vertex ab the bending stresses at A and B are equal, or the neutral axis must be parallel to the line joining A and B. Also, if the plane of loading, for pure flexure, is parallel to a side of the section modulus polygon, the neutral axis will intersect the corresponding vertex of the section.

As another example, let the plane of loading be taken as OP' (Fig. 6). The line Ob' now represents the section modulus for the point B, and by prolonging the side c to c', Oc' is obtained which is the section modulus for the point C of the beam. The bending stress at B is to the bending stress at C as Oc' is to Ob'. Since the stress is proportional to the distance from the neutral axis, the distance from C along the prolongation of the line joining B and C to the point N at which the neutral axis for pure flexure is intersected, will be,

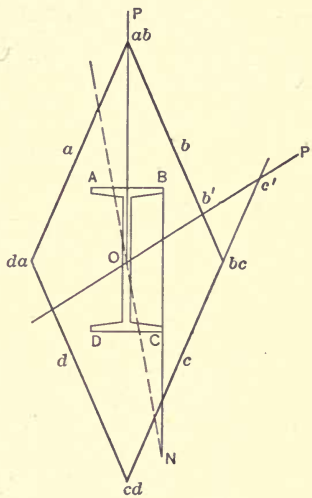


FIG. 6.

$$CN = \frac{BC}{\frac{Oc'}{Ob'} - 1} \qquad (24)$$

To observe the conditions which obtain for the angle, consider the section and polygon shown in Fig. 4. It will be seen that when the plane of loading coincides with OG the section modulus for the side DE of the angle is represented by the line from O to the vertex de of the polygon. Since the plane of loading (OG) intersects the vertex de, the neutral axis must be parallel to DE of the section, as has been explained for the case of the I-beam. However, while for the I-beam the neutral axis happened to be perpendicular to the plane of loading, in the case of the angle such an assumption is not even approximately correct. A study of the angle and its polygon will show that if the plane of loading coincides with OY, the stresses at D and at E, for pure flexure, will be of opposite sign, since the lines d and e of the polygon cut the plane of loading on opposite sides of O; or, for pure flexure with OY as the plane of loading the neutral axis will intersect the side DE of the angle within the limits of the section. As the plane of loading shifts from OG to OY the change of sign for the stress at E will occur when the neutral axis passes through E, and the neutral axis will intersect E when the plane of loading is parallel to the side e of the polygon.

Art. 6. Plane of Loading

For those cases in which the member is restrained from bending in some direction, the determination of the equivalent plane of loading may require some study. If the character of the restraint determines the direction in which bending must occur, then the position of the equivalent plane of loading can be determined by noting the direction of the neutral axis. Since the deformation is proportional to the distance from the neutral axis, the neutral axis must be parallel to the line joining any two points whose deformations are equal in amount and of the same sign. In such a case $\tan \alpha$ becomes a known quantity, and the position of the equivalent plane of loading may be computed by the use of Eqs. (20) to (22). From Eq. (20) the corresponding equation for θ becomes

$$\tan \theta = \frac{I_x - J \tan \alpha}{J - I_y \tan \alpha}. \quad . \quad . \quad . \quad . \quad . \quad (25)$$

For practical purposes the section modulus polygon may be used to determine the equivalent plane of loading, avoiding the necessity for using Eq. (25). For illustration, consider again the angle and its section modulus polygon, shown in Fig. 4. When the neutral axis is parallel to *DE* of the angle, the section modulus is represented by the line from *O* to the vertex *de*, or if the angle is riveted to a connection plate along the face *DE*, the angle being restrained from rotation parallel to the plate, and if the point of application be taken at the face of the connection plate, then the equivalent point of application of the load is *G*. If the gauge line, and, therefore, the actual point of attachment, is at *H*, the restraining couple which is called into action will have a moment arm equivalent to *GH*. It is sometimes thought that complete restraint parallel to the connection plate implies the existence of a couple having a moment arm equivalent to *MH*, but this is not the case; complete restraint parallel to the connection plate will move the equivalent point of application from either *M* or *H* to *G*, or, rather, the equivalent plane of loading to the plane *OG*. When the neutral axis is parallel to *DE* it will also be parallel to *BC*, and hence, the plane of loading which includes *O* and the vertex *de* must also pass through the vertex *bc*.

Art. 7. Combined Stresses

In determining the critical stresses for a combination of direct tension or compression with flexure, the usual methods may be used, substituting the correct value of the section modulus for the more commonly used special value.

For a member which is short enough to be considered as a prism,

$$f=\frac{F}{A}\pm\frac{M}{s}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (26)$$

in which f = unit stress due to both flexure and direct load;
F = total load or force normal to the section;
A = area of the section;
M = bending moment at the section;
s = section modulus.

If the bending moment (M) in the last equation is due to an eccentricity (e) of the force (F), then,

$$f=\frac{F}{A}\left(1\pm\frac{Ae}{s}\right). \qquad (27)$$

For a slender member, subject to both direct loading and bending, the following formula is applicable, and will be found convenient on account of its wide range of application:

$$f=\frac{F}{A}\pm\frac{M}{s\mp\frac{FL^2}{KEz}}, \qquad (28)$$

in which M = bending moment neglecting the increment of the moment which is due to the deflection of the member itself;
L = length of the member (in inches if A is in square inches);
E = coefficient of elasticity of the material;
z = distance from the extreme fiber to a line through the center of gravity of the section, parallel to or coinciding with the neutral axis;
K = a constant, the value of which is 9.6 for a simple beam uniformly loaded and 12 for a simple beam with a load at the center, and for which the value 10 is suggested for general purposes of design.

Other quantities in the last equation are as defined under Eq. (26).

In Eq. (28), the negative sign is used in the denominator for compression and the positive sign for tension.

The stress computed by Eq. (28) will be the stress at the point of maximum deflection, which for a member in compression will evidently be the critical stress, but for a member in tension the deflection reduces the eccentricity at the mid-length, and for this case the critical stress will usually be at an end section. For the stress at the end section, the computation may, in general, be made by use of Eq. (26), but for angles the increase in stress on account of the outstanding legs may need special consideration.

Art. 8. Flexure for Angles in Pairs

The case of two angles of the same section, riveted together at frequent intervals, and subjected to bending in a plane

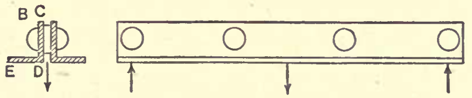


FIG. 7.

parallel to the connected legs, is indicated in Fig. 7. For such a condition the restraint which each angle exerts upon the other may be assumed to produce a deflection in the plane of bending and the neutral axis may be assumed to be perpendicular to the connected legs. The loading for each angle will then be equivalent to some loading in a plane passing through *O*, the center of area of the section, and through the vertices *bc* and *de* of the section modulus polygon, which is indicated for each angle in Fig. 8. Let *m* denote the bending moment for one angle, which if acting in the plane of *O*, *bc*, and *de* would produce the same deformations as those which result from the actual loading for the pair of angles. The actual moment must be equal to the resultant of the two moments m, or

$$M = 2m \sin \theta, \quad . \quad . \quad . \quad . \qquad (29)$$

in which M = actual bending moment for the pair of angles;
m = equivalent bending moment for one angle;
θ = angle which the plane for m makes with the neutral axis for the pair of angles.

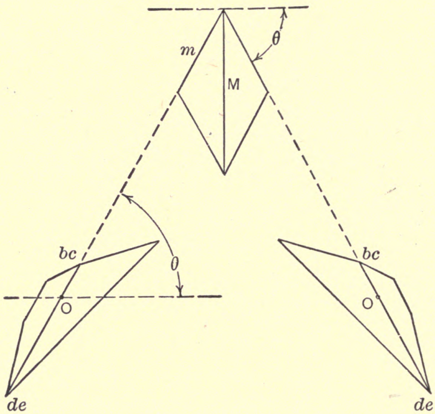


FIG. 8.

The bending stress for each angle is equal to m divided by the section modulus in its plane, or

$$f = \frac{M}{2s \sin \theta}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \qquad (30)$$

in which f = unit stress at the extreme fiber;
s = section modulus for the plane of m.

In Eq. (30), the value of $s \sin \theta$ may be considered as the equivalent section modulus for one angle of the pair for half of the total vertical load. For the case illustrated, this value is equal to the y-coordinate of bc, for the edge BC of the angle, or to the y-coordinate of de for the edge DE of the angle.

Thus, for angles in pairs, the equivalent section modulus for one angle can be obtained directly from a table of coordinates of section modulus polygons. However, even this is unnecessary if a table of properties of sections is at hand, for the values of the coordinates in question are each obtained by dividing the moment of inertia by the distance from the neutral axis to the extreme fiber. In other words, the stress for the pair of angles, for bending in the plane of symmetry, may be computed as for a single symmetrical section, provided the two angles are firmly attached to each other. For the case shown in Fig. 7, independent action upon the part of each angle would tend to crowd the angles toward each other at the midspan.

Art. 9. Transfer of Stress by Shear to an Outstanding Leg

In a member consisting of one or more angles, the critical stress is likely to occur at a section near the connection of the member to one of its connection planes, particularly in the case of tension members. At such a section there may be considerable variation in the distribution of the stress, due to a difference in the deformations of the connected and the outstanding legs of each angle. In order to make an approximate determination of the stress distribution, due to the transfer of stress to the outstanding leg by shear, consider the case shown in Fig. 9, in which there are two angles connected to opposite sides of a connection plate. In this case the stress at a section

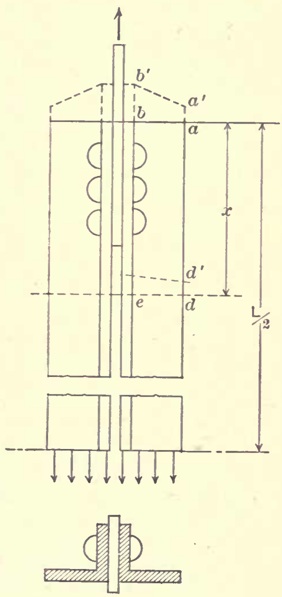


FIG. 9.

taken at the middle of the length of the member will be assumed * to be uniformly distributed, but at the end of the member the point a is subject to slightly less deformation than the point b. If it be assumed that the stress increases at a uniform rate from zero at point a to the average unit stress at the center of the length of the member, then at any section distant x from the point a the unit stress at the extreme fiber of the outstanding leg will be

$$f'=\frac{2x}{L}\cdot\frac{F}{A}, \quad . \quad . \quad . \quad . \quad . \quad . \quad (31)$$

in which f' = unit stress at the extreme fiber of the outstanding leg;

x = distance from the end of the angle to the section at which f' is taken;

L = length of the angle;

F = total stress or force acting lengthwise of the angle;

A = area of cross-section of the angle.

Also, let f be the unit stress in the connected leg of the angle at the section at which f' is taken. Then, for equilibrium at the section x distant from the end of the angle,

$$F=\tfrac{1}{2}(f+f')A_1+fA_2, \quad . \quad . \quad . \quad . \quad . \quad (32)$$

in which A_1 = area of the outstanding leg;

A_2 = area of the connected leg.

Or, substituting the value of f' from Eq. (31) in Eq. (32), and solving for f,

$$f=2\frac{F}{A}\left[\frac{1-\dfrac{x}{L}\cdot\dfrac{A_1}{A}}{1+\dfrac{A_2}{A}}\right]. \quad . \quad . \quad . \quad . \quad . \quad . \quad (33)$$

* The reasonableness of the assumptions of this article will be better understood by a study of the results of tests by Prof. Cyril Batho, reported in an article on "The Effect of End Connections on the Distribution of Stress in Certain Tension Members," Journal of the Franklin Institute, August, 1915.

Art. 10. Efficiency of End Connections

The efficiency of a member may be taken as the relation of the average to the maximum stress, or if, in Eq. (33), x is taken so that f will be the maximum stress, the equation for the efficiency for the transfer of stress by shear to the outstanding leg will be,

$$E_1=\frac{1}{2}\left(\frac{A+A_2}{A-\frac{x}{L}A_1}\right), \qquad (34)$$

in which E_1 is the efficiency, and the other quantities are as defined under Eqs. (31) and (32).

In place of the areas A_1 and A_2 the widths of the legs of the angle may be used. Using tl_1 for A_1 and tl_2 for A_2, the equations corresponding to Eqs. (32), (33), and (34) become

$$\frac{F}{A}[l_1+l_2]=\frac{1}{2}(f+f')l_1+fl_2, \qquad (35)$$

or

$$f=2\frac{F}{A}\left[\frac{l_1+l_2-\frac{x}{L}l_1}{l_1+2l_2}\right], \qquad (36)$$

and

$$E_1=\frac{1}{2}\left[\frac{l_1+2l_2}{l_1+l_2-\frac{x}{L}l_1}\right]. \qquad (37)$$

For use in designing, the critical section will usually be taken through the connection rivet or rivets most distant from the end of the angle, in which case the net areas of the legs will be used for A_1 and A_2, or in Eqs. (35), (36) and (37), the values of the widths of legs must be corrected to their net values. For such a case the equations become

$$\frac{F}{A}[l_1+l_2]=\frac{1}{2}(f+f')(l_1-n_1d)+f(l_2-n_2d), \qquad (38)$$

or

$$f=2\frac{F}{A}\left[\frac{l_1+l_2-\frac{x}{L}l_1+\frac{x}{L}n_1d}{l_1+2l_2-n_1d-2n_2d}\right], \quad . \quad . \quad . \quad (39)$$

and

$$E_1=\frac{1}{2}\left[\frac{l_1+2l_2-n_1d-2n_2d}{l_1+l_2-\frac{x}{L}l_1+\frac{x}{L}n_1d}\right], \quad . \quad . \quad . \quad (40)$$

in which f = maximum unit stress at the critical section;
E_1 = efficiency of net section relative to gross section;
l_1 = width of the outstanding leg;*
l_2 = width of the connected leg;*
n_1 = number of rivet holes in the outstanding leg which are cut by the critical section;
n_2 = number of rivet holes in the connected leg which are cut by the critical section;
d = diameter of each rivet hole;
x = distance from the end of the angle to the critical section;
L = total length of angle.

For a connection with lug angles, the length of the lug may be added to both x and $\frac{L}{2}$, in the equations just given, but this must be considered as a rather crude approximation.

Since the equations of articles 9 and 10 are developed upon the assumption that the angle is restrained from bending, they are applicable in particular to pairs of angles riveted to opposite sides of a connection plate, but, as will be shown later, they may also be used in the design of single angles. Structural specifications are inclined to be both indefinite and unsatisfactory with reference to the requirements for connections. If any clause relating to this matter is included,

* For exact work reduce the outside dimension of the leg by half the thickness of the angle.

it usually stipulates that each angle must be connected by both legs or that only one leg shall be considered as effective area. The results of tests indicate that the allowance of only one leg as effective area is too rigid a requirement, even though but one leg of the angle is connected; while on the other hand the use of a lug angle to connect the outstanding leg results in too liberal an allowance for the capacity of the angle. Eq. (40) furnishes a ready means for estimating the efficiency of angles used in pairs, and as already mentioned may be used for connections with or without lug angles. For an angle without lugs, n_1 will become zero. For this case the author has computed the efficiency of those angles which are most used, the values for which are given in Tables IV and V, at the back of the book. In the same tables, there is given for each angle, the area which if entirely effective at the maximum unit stress would be equal in strength to the connected angle for the computed efficiency. Also, the total allowable stress for a maximum unit stress of 16,000 pounds per square inch at the critical section is tabulated.

In the case of a single angle attached to a connection plate, there may be nearly complete restraint parallel to the plate with but little restraint perpendicular to the plate. In this case bending and shear each have an effect, but within the limits of working stresses the effect of the longitudinal shear may usually be neglected. In the development of Eqs. (31) to (40), inclusive, it was assumed that the stress at the center of the member was uniformly distributed. While this condition will be nearly fulfilled for angles in pairs, a single angle, with a small load, will be subjected to bending throughout its length, in which case the stress at the extreme edge of the outstanding leg will be less than the average stress, or may be of opposite sign. For the last-named case the stresses at the midsection may be as indicated in Fig. 10, in which f_1 represents the unit stress at the face of the connected leg and f_2 the unit stress at the extreme fibers of the outstanding leg.

At some distance b from f_2, the horizontal shear will be zero, and the stress which must be transferred by horizontal shear from the connected to the outstanding leg will be equal to the sum of the stresses between connected leg and the section of zero horizontal shear. Furthermore, if it be assumed that the angle is restrained from bending until the horizontal shear necessary to transfer stress to the outstanding leg has occurred, then at the critical section the moment arm tending to produce bending will be the distance from the centroid of the stresses at the section to the line of action of the applied force in the connection plate. But, on account of the variation of the stresses across the section, due to the longitudinal shear, the centroid of the stresses will lie between the center of area of the section and line of action of the force in the connection plate. In other words the neglect of the horizontal shear for this condition will be partially counterbalanced by the reduction in the moment arm due to the shear, and designs may be made on the basis of the bending and direct stresses. In this case for one angle in tension, the stress may be computed by Eq. (27), or the efficiency for direct tension and flexure will be

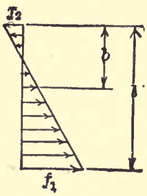


FIG. 10.

$$E_2 = \frac{1}{1 + \frac{Ae}{s}}, \qquad (41)$$

in which E_2 = efficiency of a single angle for eccentric tension;

s = section modulus of the critical section for the given loading;

A = area of section;

e = eccentricity of the applied load at the critical section.

In using Eq. (41) the critical section will be at some distance from the extreme end of the angle. Hence, the value of e to be used will be less than that at the end section, due to the deflection of the angle. Since this reduction in e may result in an appreciable increase in the value of E_2, its determination may be desired. In Fig. 11, e_c represents the resulting eccentricity at the center, e is the eccentricity

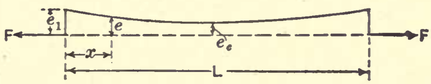


FIG. 11.

at the critical section, and e_1 is the eccentricity at the end. The maximum stress at the midsection in terms of e_c is

$$f=\frac{F}{A}\left(1+\frac{Ae_c}{s}\right), \quad \ldots \ldots \quad (42)$$

or in terms of e_1 it is

$$f=\frac{F}{A}+\frac{Fe_1}{s+\frac{FL^2}{KEz}}, \quad \ldots \ldots \quad (43)$$

in accordance with Eq. (28), to which the reader is referred for nomenclature.

Equating the values of f in Eqs. (42) and (43),

$$e_c=\frac{e_1}{1+\frac{FL^2}{KEzs}}, \quad \ldots \ldots \quad (44)$$

in which e_1 is eccentricity of the applied load at the end section, and the other values are as stated for Eq. (28).

At the instant that the angle begins to deflect, the moment at every section is Fe_1 and the elastic curve, for this value of the moment, would be a parabola. As the load increases, the deflection at the midsection approaches zero as a limit, and if for this condition e be assumed proportional to $\left(\frac{L}{2}-x\right)^n$, the resulting elastic curve will give e proportional to $\left(\frac{L}{2}-x\right)^{n+2}$, or the limit toward which the curve tends is that for which the value of e is proportional to $\left(\frac{L}{2}-x\right)^\infty$. The significance of this may be appreciated by reference to Fig. 12. The bending would all occur at the end of the unsupported length, and the centroid of the stresses throughout this unsupported length would coincide with the line of action of the applied forces. In reality this limit can not be reached, for some bending occurs throughout the unsupported length, and at any section this resisting moment must balance the moment which is equal to the resultant force F multiplied

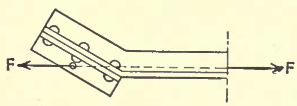


Fig. 12.

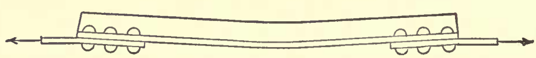


Fig. 13.

by the distance from the centroid of the stresses to the line of action of the applied force. Evidently, the curve of the neutral surface for the unsupported length of the angle will approximate the form of the parabola, and at the end of the unsupported length the maximum bending stresses will be developed. For an angle attached to a plate the section of the sharp bend will be transferred to the connection plate and will occur close to the end of the angle, as indicated in Fig. 13. Therefore, the curve throughout the length may ordinarily be taken as a parabola, for which the value of e in Fig. 11 becomes

$$e=e_c+4(e_1-e_c)\left(\frac{1}{2}-\frac{x}{L}\right)^2, \quad . \quad . \quad . \quad . \quad (45)$$

in which e = eccentricity at the critical section;
e_c = eccentricity at the midsection;
e_1 = eccentricity at the end section;
x = distance from the end of the angle to the critical section;
L = length of angle.

It is evident that for large stresses and for practically all cases of ultimate loads the condition indicated in Fig. 12 will be nearly fulfilled and that the stresses at the critical section will tend to become identical with those which were determined in Art. 9. In this case the efficiency becomes identical with the value derived for pairs of angles, as given in Eqs. (34) and (40). Of the two efficiencies which have been derived, one for the transfer of stress to the web and the other for the bending stress, the lower of the two should control in the design. As the load becomes large the value of e at the critical section becomes small, and the efficiency for transfer of stress becomes dominant. That value may, therefore, reasonably be used as a basis for design, for tension members.

It may be of interest to compare some values obtained by experiment with the values for efficiency computed by Eq. (40). Table A contains a summary of the average values for tests made by Prof. F. P. McKibben and reported in Engineering News, Vol. 56, page 14, and Vol. 58, page 190.

In studying the results for Table A, it should be remembered that Eq. (40) is developed for a straight line relation of stresses at the critical section, whereas at the ultimate load the stress is not proportional to the deformation and that in this case it will cause the computed efficiency to be less than that observed for the tests. On the other hand, influences which produce bending parallel to the outstanding leg of the connection tend to make the efficiency obtained by experiment lower than the efficiency computed by Eq. (40), which neglects this bending. On the whole the results obtained

TABLE A

COMPARISON OF COMPUTED AND OBSERVED EFFICIENCIES OF CONNECTIONS FOR SPECIMENS TESTED BY PROF. McKIBBEN

Reference Number.	Main Angles.*				Lug Angles.				$L = L_1 + 2L_2$	x	$\frac{15}{16}''$ Holes.		Efficiency in Per cent.		Remarks.
	Number.	l_1 In.	l_2 In.	L'gth. L_1	Number.	l_1	l_2	Length. L_2	Ft.	Ft.	n_1	n_2	By Equation (40).	By McKibben's Tests.	
A_1	1	3	$3\frac{1}{2}$	5′–4″	0	. .	. .	. . . . .	5.33	1.20	0	1	69.4	68.0	
A_2	1	3	$3\frac{1}{2}$	5′–4″	1	3	3	0′–$9\frac{1}{2}$″	6.92	1.35	1	1	63.5	64.9	
B_1	1	3	4	5′–4″	0	. .	. .	. . . . .	5.33	1.20	0	1	72.1	64.1	
B_2	1	3	4	5′–4″	1	3	3	0′– $9\frac{1}{2}$″	6.92	1.35	1	1	61.3	64.1	
B_3	1	3	4	5′–4″	0	. .	. .	. . . . .	5.33	1.20	0	1	72.1	69.1	
C_1	1	4	6	5′–4″	0	. .	. .	. . . . .	5.33	1.46	0	2	68.5	70.5	
C_2	1	4	6	5′–4″	1	4	3	1′– 3″	7.83	2.37	1	2	61.7	72.7	
D_1	2	3	3	5′–4″	0	. .	. .	. . . . .	5.33	1.37	0	1	67.7	64.8	
D_2	2	3	3	5′–4″	2	3	3	0′–$10\frac{1}{2}$″	7.08	1.50	1	1	54.3	66.4	
A_3	1	3	$3\frac{1}{2}$	5′–4″	1	3	3	0′–$11\frac{1}{2}$″	7.25	1.52	1	1	58.1	74.2	
A_4	1	3	$3\frac{1}{2}$	5′–4″	1	3	3	0′–$11\frac{1}{2}$″	7.25	1.52	1	1	58.1	75.9	
A_5	1	3	$3\frac{1}{2}$	5′–4″	1	3	3	0′–$11\frac{1}{2}$″	7.83	2.37	1	1	60.1	76.4	$L_2 \doteq 1'–3'$
B_4	1	3	4	5′–4″	1	3	3	0′–$11\frac{1}{2}$″	7.25	1.52	1	1	61.5	77.4	
B_5	1	3	4	5′–4″	1	3	3	0′–$11\frac{1}{2}$″	7.25	1.52	1	1	61.5	79.0	
B_6	1	3	4	5′–4″	1	3	3	0′–$11\frac{1}{2}$″	7.25	1.52	1	1	61.5	70.3	
B_7	1	3	4	5′–4″	1	3	3	0′–$11\frac{1}{4}$″	7.21	1.50	1	1	61.5	79.1	
B_8	1	3	4	5′–4″	1	3	3	0′–11″	7.19	1.48	1	1	61.5	70.9	
C_3	1	4	6	5′–4 ′	0	. .	. .	. . . . .	5.33	1.51	0	1	79.7	71.6	
C_4	1	4	6	5′–4″	0	. .	. .	. . . . .	5.33	1.51	0	2	68.7	70.5	
C_5	1	4	6	5′–4″	1	3	4	1′–1″	7.49	2.09	0	2	68.7	69.4	
D_3	2	3	3	5′–4″	0	. .	. .	. . . . .	5.33	1.37	0	1	67.7	68.9	
D_4	2	3	3	5′–4″	2	3	3	1′–0″	7.33	1.83	1	1	55.2	67.4	

* Thickness of metal for D_1, D_2, D_3, and D_4 was $\frac{5}{16}$ inch, and for all other specimens $\frac{3}{8}$ inch.

by computation appear to be sufficiently conservative to warrant the presentation of the method for practical use, until a better method shall be proposed.

For a single angle in compression, the critical section for bending will be at the mid-length, the maximum stress may be computed by Eq. (28), and the efficiency for direct compression and flexure will be

$$E_3 = \frac{1}{1 + \dfrac{Ae}{s - \dfrac{Fl^2}{KEz}}}, \quad . \quad . \quad . \quad . \quad . \quad . \quad (42)$$

in which E_3 = efficiency of a single angle for eccentric compression;

s = section modulus of the critical section for the given loading;

A = area of section;

e = moment arm at the end section of the couple producing flexure;

F = total applied force;

l = length of member;

K = a constant, for which the value 10 may be used;

E = modulus of elasticity of steel, usually taken as either 29,000,000 or 30,000,000;

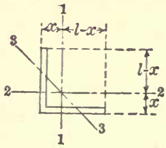
z = distance from the extreme fiber to a line through the center of area of the section and parallel to the neutral axis.

The efficiency of the connection may be taken identical with the values given for tension, and if this is lower than the value obtained from Eq. (42), it should govern the design.

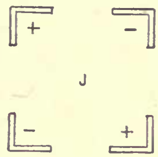
TABLES

TABLE I

Elements of Angles with Equal Legs *



I = moment of inertia
J = product of inertia
r = radius of gyration

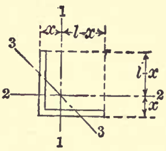


Size.	Weight per Foot.	Area of Section.	Axis 1–1 and Axis 2–2.					Axis 3–3.
			I	r	$\frac{I}{l-x}$	x	J	r min.
Inches.	Pounds.	In.^{2}	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.
$8\times8\times1\frac{1}{8}$	56.9	16.73	98.0	2.42	17.5	2.41	57.3	1.55
$8\times8\times1\frac{1}{16}$	54.0	15.87	93.5	2.43	16.7	2.39	54.7	1.56
$8\times8\times1$	51.0	15.00	89.0	2.44	15.8	2.37	52.1	1.56
$8\times8\times\frac{15}{16}$	48.1	14.12	84.3	2.44	14.9	2.34	49.6	1.56
$8\times8\times\frac{7}{8}$	45.0	13.23	79.6	2.45	14.0	2.32	47.1	1.56
$8\times8\times\frac{13}{16}$	42.0	12.34	74.7	2.46	13.1	2.30	44.2	1.57
$8\times8\times\frac{3}{4}$	38.9	11.44	69.7	2.47	12.2	2.28	41.2	1.57
$8\times8\times\frac{11}{16}$	35.8	10.53	64.6	2.48	11.2	2.25	38.3	1.58
$8\times8\times\frac{5}{8}$	32.7	9.61	59.4	2.49	10.3	2.23	35.4	1.58
$8\times8\times\frac{9}{16}$	29.6	8.68	54.1	2.50	9.3	2.21	32.1	1.58
$8\times8\times\frac{1}{2}$	26.4	7.75	48.6	2.51	8.4	2.19	28.9	1.58
$6\times6\times1$	37.4	11.00	35.5	1.80	8.6	1.86	20.6	1.16
$6\times6\times\frac{15}{16}$	35.3	10.37	33.7	1.80	8.1	1.84	19.6	1.16
$6\times6\times\frac{7}{8}$	33.1	9.73	31.9	1.81	7.6	1.82	18.6	1.17
$6\times6\times\frac{13}{16}$	31.0	9.09	30.1	1.82	7.2	1.80	17.5	1.17
$6\times6\times\frac{3}{4}$	28.7	8.44	28.2	1.83	6.7	1.78	16.4	1.17
$6\times6\times\frac{11}{16}$	26.5	7.78	26.2	1.83	6.2	1.75	15.4	1.17
$6\times6\times\frac{5}{8}$	24.2	7.11	24.2	1.84	5.7	1.73	14.3	1.17
$6\times6\times\frac{9}{16}$	21.9	6.43	22.1	1.85	5.1	1.71	13.1	1.18
$6\times6\times\frac{1}{2}$	19.6	5.75	19.9	1.86	4.6	1.68	11.9	1.18
$6\times6\times\frac{7}{16}$	17.2	5.06	17.7	1.87	4.1	1.66	10.6	1.19
$6\times6\times\frac{3}{8}$	14.9	4.36	15.4	1.88	3.5	1.64	9.2	1.19

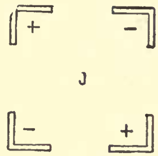
* The values of J were computed by the author. The remaining values in this table are from the Carnegie Pocket Companion, and are used with permission of the Carnegie Steel Company.

TABLE I—*Continued*

Elements of Angles with Equal Legs



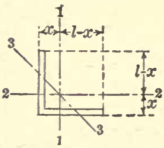
I = moment of inertia
J = product of inertia
r = radius of gyration



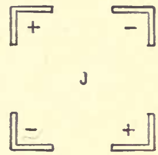
Size.	Weight per Foot.	Area of Section.	Axis 1–1 and Axis 2–2.					Axis 3–3.
			I	r	$\frac{I}{l-x}$	x	J	r min.
Inches.	Pounds.	In.^{2}	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.
5×5×1	30.6	9.00	19.6	1.48	5.8	1.61	11.1	0.96
5×5×$\frac{15}{16}$	28.9	8.50	18.7	1.48	5.5	1.59	10.6	0.96
5×5×$\frac{7}{8}$	27.2	7.98	17.8	1.49	5.2	1.57	10.1	0.96
5×5×$\frac{13}{16}$	25.4	7.47	16.8	1.50	4.9	1.55	9.6	0.97
5×5×$\frac{3}{4}$	23.6	6.94	15.7	1.50	4.5	1.52	9.2	0.97
5×5×$\frac{11}{16}$	21.8	6.40	14.7	1.51	4.2	1.50	8.6	0.97
5×5×$\frac{5}{8}$	20.0	5.86	13.6	1.52	3.9	1.48	8.0	0.97
5×5×$\frac{9}{16}$	18.1	5.31	12.4	1.53	3.5	1.46	7.4	0.98
5×5×$\frac{1}{2}$	16.2	4.75	11.3	1.54	3.2	1.43	6.7	0.98
5×5×$\frac{7}{16}$	14.3	4.18	10.0	1.55	2.8	1.41	6.1	0.98
5×5×$\frac{3}{8}$	12.3	3.61	8.7	1.56	2.4	1.39	5.4	0.99
4×4×$\frac{13}{16}$	19.9	5.84	8.1	1.18	3.0	1.29	4.6	0.77
4×4×$\frac{3}{4}$	18.5	5.44	7.7	1.19	2.8	1.27	4.4	0.77
4×4×$\frac{11}{16}$	17.1	5.03	7.2	1.19	2.6	1.25	4.1	0.77
4×4×$\frac{5}{8}$	15.7	4.61	6.7	1.20	2.4	1.23	3.8	0.77
4×4×$\frac{9}{16}$	14.3	4.18	6.1	1.21	2.2	1.21	3.5	0.78
4×4×$\frac{1}{2}$	12.8	3.75	5.6	1.22	2.0	1.18	3.2	0.78
4×4×$\frac{7}{16}$	11.3	3.31	5.0	1.23	1.8	1.16	2.9	0.78
4×4×$\frac{3}{8}$	9.8	2.86	4.4	1.23	1.5	1.14	2.6	0.79
4×4×$\frac{5}{16}$	8.2	2.40	3.7	1.24	1.3	1.12	2.2	0.79
4×4×$\frac{1}{4}$	6.6	1.94	3.0	1.25	1.0	1.09	1.8	0.79
$3\frac{1}{2}$×$3\frac{1}{2}$×$\frac{13}{16}$	17.1	5.03	5.3	1.02	2.3	1.17	2.9	0.67
$3\frac{1}{2}$×$3\frac{1}{2}$×$\frac{3}{4}$	16.0	4.69	5.0	1.03	2.1	1.15	2.8	0.67
$3\frac{1}{2}$×$3\frac{1}{2}$×$\frac{11}{16}$	14.8	4.34	4.7	1.04	2.0	1.12	2.6	0.67
$3\frac{1}{2}$×$3\frac{1}{2}$×$\frac{5}{8}$	13.6	3.98	4.3	1.04	1.8	1.10	2.5	0.68
$3\frac{1}{2}$×$3\frac{1}{2}$×$\frac{9}{16}$	12.4	3.62	4.0	1.05	1.6	1.08	2.3	0.68
$3\frac{1}{2}$×$3\frac{1}{2}$×$\frac{1}{2}$	11.1	3.25	3.6	1.06	1.5	1.06	2.1	0.68

TABLE I—*Concluded*

Elements of Angles with Equal Legs



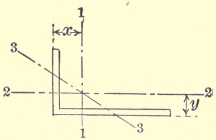
I = moment of inertia
J = product of inertia
r = radius of gyration



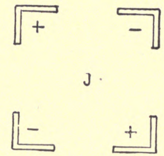
Size.	Weight per Foot.	Area of Section.	Axis 1–1 and Axis 2–2.					Axis 3–3.
			I	r	$\frac{I}{l-x}$	x	J	r min.
Inches.	Lbs.	In.^{2}	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{7}{16}$	9.8	2.87	3.3	1.07	1.3	1.04	1.9	0.68
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{3}{8}$	8.5	2.48	2.9	1.07	1.2	1.01	1.7	0.69
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{5}{16}$	7.2	2.09	2.5	1.08	0.98	0.99	1.5	0.69
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{1}{4}$	5.8	1.69	2.0	1.09	0.79	0.97	1.2	0.69
$3\times3\times\frac{5}{8}$	11.5	3.36	2.6	0.88	1.3	0.98	1.5	0.57
$3\times3\times\frac{9}{16}$	10.4	3.06	2.4	0.89	1.2	0.95	1.4	0.58
$3\times3\times\frac{1}{2}$	9.4	2.75	2.2	0.90	1.1	0.93	1.3	0.58
$3\times3\times\frac{7}{16}$	8.3	2.43	2.0	0.91	0.95	0.91	1.1	0.58
$3\times3\times\frac{3}{8}$	7.2	2.11	1.8	0.91	0.83	0.89	1.0	0.58
$3\times3\times\frac{5}{16}$	6.1	1.78	1.5	0.92	0.71	0.87	0.87	0.59
$3\times3\times\frac{1}{4}$	4.9	1.44	1.2	0.93	0.58	0.84	0.75	0.59
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{2}$	7.7	2.25	1.2	0.74	0.73	0.81	0.68	0.47
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{7}{16}$	6.8	2.00	1.1	0.75	0.65	0.78	0.62	0.48
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{8}$	5.9	1.73	0.98	0.75	0.57	0.76	0.57	0.48
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{5}{16}$	5.0	1.47	0.85	0.76	0.48	0.74	0.49	0.49
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{4}$	4.1	1.19	0.70	0.77	0.39	0.72	0.41	0.49
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{16}$	3.07	0.90	0.55	0.78	0.30	0.69	0.32	0.49
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{8}$	2.08	0.61	0.38	0.79	0.20	0.67	0.23	0.50
$2\times2\times\frac{7}{16}$	5.3	1.56	0.54	0.59	0.40	0.66	0.30	0.39
$2\times2\times\frac{3}{8}$	4.7	1.36	0.48	0.59	0.35	0.64	0.27	0.39
$2\times2\times\frac{5}{16}$	3.92	1.15	0.42	0.60	0.30	0.61	0.24	0.39
$2\times2\times\frac{1}{4}$	3.19	0.94	0.35	0.61	0.25	0.59	0.21	0.39
$2\times2\times\frac{3}{16}$	2.44	0.71	0.28	0.62	0.19	0.57	0.16	0.40
$2\times2\times\frac{1}{8}$	1.65	0.48	0.19	0.63	0.13	0.55	0.11	0.40

TABLE II

Elements of Angles with Unequal Legs *



I = moment of inertia
J = product of inertia
r = radius of gyration



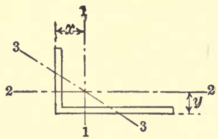
Size.	Weight per Foot.	Area of Section.	Axis 1–1.				Axis 2–2.				Axis 1–1 and 2–2.	Axis 3–3.
			I_1	r_1	$\frac{I_1}{l_1-x}$	x	I_2	r_2	$\frac{I_2}{l_2-y}$	y	J	r min.
Inches.	Pounds.	In.^{2}	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.
$8\times6\times1$	44.2	13.0	80.8	2.49	15.1	2.65	38.8	1.73	8.9	1.65	32.5	1.28
$8\times6\times\frac{15}{16}$	41.7	12.25	76.6	2.50	14.3	2.63	36.8	1.73	8.4	1.63	30.8	1.28
$8\times6\times\frac{7}{8}$	39.1	11.48	72.3	2.51	13.4	2.61	34.9	1.74	7.9	1.61	29.2	1.28
$8\times6\times\frac{13}{16}$	36.5	10.72	67.9	2.52	12.5	2.59	32.8	1.75	7.4	1.59	27.6	1.29
$8\times6\times\frac{3}{4}$	33.8	9.94	63.4	2.53	11.7	2.56	30.7	1.76	6.9	1.56	26.0	1.29
$8\times6\times\frac{11}{16}$	31.2	9.15	58.8	2.54	10.8	2.54	28.6	1.77	6.4	1.54	24.1	1.29
$8\times6\times\frac{5}{8}$	28.5	8.36	54.1	2.54	9.9	2.52	26.3	1.77	5.9	1.52	22.2	1.30
$8\times6\times\frac{9}{16}$	25.7	7.56	49.3	2.55	8.9	2.50	24.0	1.78	5.3	1.50	20.3	1.30
$8\times6\times\frac{1}{2}$	23.0	6.75	44.3	2.56	8.0	2.47	21.7	1.79	4.8	1.47	18.4	1.30
$8\times6\times\frac{7}{16}$	20.2	5.93	39.2	2.57	7.1	2.45	19.3	1.80	4.2	1.45	16.3	1.30

$8\times3\frac{1}{2}\times1$	35.7	10.50	66.2	2.51	13.7	3.17	7.8	0.86	3.0	0.92	11.6	0.73
$8\times3\frac{1}{2}\times\frac{15}{16}$	33.7	9.90	62.9	2.52	12.9	3.14	7.4	0.87	2.9	0.89	11.2	0.73
$8\times3\frac{1}{2}\times\frac{7}{8}$	31.7	9.30	59.4	2.53	12.2	3.12	7.1	0.87	2.7	0.87	10.8	0.73
$8\times3\frac{1}{2}\times\frac{13}{16}$	29.6	9.68	55.9	2.54	11.4	3.10	6.7	0.88	2.5	0.85	10.3	0.73
$8\times3\frac{1}{2}\times\frac{3}{4}$	27.5	8.06	52.3	2.55	10.6	3.07	6.3	0.88	2.3	0.82	9.8	0.73
$8\times3\frac{1}{2}\times\frac{11}{16}$	25.3	7.43	48.5	2.56	9.8	3.05	5.9	0.89	2.2	0.80	9.1	0.73
$8\times3\frac{1}{2}\times\frac{5}{8}$	23.2	6.80	44.7	2.57	9.0	3.03	5.4	0.90	2.0	0.78	8.4	0.74
$8\times3\frac{1}{2}\times\frac{9}{16}$	21.0	6.15	40.8	2.57	8.2	3.00	5.0	0.90	1.8	0.75	7.7	0.74
$8\times3\frac{1}{2}\times\frac{1}{2}$	18.7	5.50	36.7	2.58	7.3	2.98	4.5	0.91	1.6	0.73	7.1	0.74
$8\times3\frac{1}{2}\times\frac{7}{16}$	16.5	4.84	32.5	2.59	6.4	2.95	4.1	0.92	1.5	0.70	6.4	0.74
$7\times3\frac{1}{2}\times1$	32.3	9.50	45.4	2.19	10.6	2.71	7.5	0.89	3.0	0.96	9.7	0.74
$7\times3\frac{1}{2}\times\frac{15}{16}$	30.5	8.97	43.1	2.19	10.0	2.69	7.2	0.89	2.8	0.94	9.3	0.74
$7\times3\frac{1}{2}\times\frac{7}{8}$	28.7	8.42	40.8	2.20	9.4	2.66	6.8	0.90	2.6	0.91	9.0	0.74
$7\times3\frac{1}{2}\times\frac{13}{16}$	26.8	7.87	38.4	2.21	8.8	2.64	6.5	0.91	2.5	0.89	8.6	0.74
$7\times3\frac{1}{2}\times\frac{3}{4}$	24.9	7.31	36.0	2.22	8.2	2.62	6.1	0.91	2.3	0.87	8.1	0.74
$7\times3\frac{1}{2}\times\frac{11}{16}$	23.0	6.75	33.5	2.23	7.6	2.60	5.7	0.92	2.1	0.85	7.6	0.74
$7\times3\frac{1}{2}\times\frac{5}{8}$	21.0	6.17	30.9	2.24	7.0	2.57	5.3	0.93	2.0	0.82	7.1	0.75
$7\times3\frac{1}{2}\times\frac{9}{16}$	19.1	5.59	28.2	2.25	6.3	2.55	4.9	0.93	1.8	0.80	6.5	0.75
$7\times3\frac{1}{2}\times\frac{1}{2}$	17.0	5.00	25.4	2.25	5.7	2.53	4.4	0.94	1.6	0.78	5.9	0.75
$7\times3\frac{1}{2}\times\frac{7}{16}$	15.0	4.40	22.6	2.26	5.0	2.50	4.0	0.95	1.4	0.75	5.3	0.76
$7\times3\frac{1}{2}\times\frac{3}{8}$	13.0	3.80	19.6	2.27	4.3	2.48	3.5	0.96	1.3	0.73	4.7	0.76

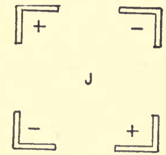
* The values of J given in this table were computed by the author. The remaining values are from the Carnegie Pocket Companion and are used with permission of the Carnegie Steel Company.

TABLE II—*Continued*

Elements of Angles with Unequal Legs



I = moment of inertia
J = product of inertia
r = radius of gyration

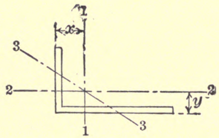


Size.	Weight per Foot.	Area of Section.	Axis 1–1.				Axis 2–2.				Axis 1–1 and 2–2.	Axis 3–3.
			I_1	r_1	$\frac{I_1}{l_1-x}$	x	I_2	r_2	$\frac{I_2}{l_2-y}$	y	J	r min.
Inches.	Pounds.	In.^{2}	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.
6×4 ×1	30.6	9.00	30.8	1.85	8.0	2.17	10.8	1.09	3.8	1.17	9.9	0.85
6×4 ×$\frac{15}{16}$	28.9	8.50	29.3	1.86	7.6	2.14	10.3	1.10	3.6	1.14	9.6	0.85
6×4 ×$\frac{7}{8}$	27.2	7.98	27.7	1.86	7.2	2.12	9.8	1.11	3.4	1.12	9.3	0.86
6×4 ×$\frac{13}{16}$	25.4	7.47	26.1	1.87	6.7	2.10	9.2	1.11	3.2	1.10	8.8	0.86
6×4 ×$\frac{3}{4}$	23.6	6.94	24.5	1.88	6.2	2.08	8.7	1.12	3.0	1.08	8.3	0.86
6×4 ×$\frac{11}{16}$	21.8	6.40	22.8	1.89	5.8	2.06	8.1	1.13	2.8	1.06	7.8	0.86
6×4 ×$\frac{5}{8}$	20.0	5.86	21.1	1.90	5.3	2.03	7.5	1.13	2.5	1.03	7.3	0.86
6×4 ×$\frac{9}{16}$	18.1	5.31	19.3	1.90	4.8	2.01	6.9	1.14	2.3	1.01	6.6	0.87
6×4 ×$\frac{1}{2}$	16.2	4.75	17.4	1.91	4.3	1.99	6.3	1.15	2.1	0.99	6.0	0.87
6×4 ×$\frac{7}{16}$	14.3	4.18	15.5	1.92	3.8	1.96	5.6	1.16	1.8	0.96	5.4	0.87
6×4 ×$\frac{3}{8}$	12.3	3.61	13.5	1.93	3.3	1.94	4.9	1.17	1.6	0.94	4.8	0.88

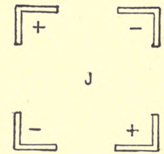
6×3½×1	28.9	8.50	29.2	1.85	7.8	2.26	7.2	0.92	2.9	1.01	7.8	0.74
6×3½×$\frac{15}{16}$	27.3	8.03	27.8	1.86	7.4	2.24	6.9	0.93	2.7	0.99	7.5	0.74
6×3½×$\frac{7}{8}$	25.7	7.55	26.4	1.87	7.0	2.22	6.6	0.93	2.6	0.97	7.2	0.75
6×3½×$\frac{13}{16}$	24.0	7.06	24.9	1.88	6.6	2.20	6.2	0.94	2.4	0.95	6.8	0.75
6×3½×$\frac{3}{4}$	22.4	6.56	23.3	1.89	6.1	2.18	5.8	0.94	2.3	0.93	6.4	0.75
6×3½×$\frac{11}{16}$	20.6	6.06	21.7	1.89	5.6	2.15	5.5	0.95	2.1	0.90	6.0	0.75
6×3½×$\frac{5}{8}$	18.9	5.55	20.1	1.90	5.2	2.13	5.1	0.96	1.9	0.88	5.7	0.75
6×3½×$\frac{9}{16}$	17.1	5.03	18.4	1.91	4.7	2.11	4.7	0.96	1.8	0.86	5.2	0.75
6×3½×½	15.3	4.50	16.6	1.92	4.2	2.08	4.3	0.97	1.6	0.83	4.8	0.76
6×3½×$\frac{7}{16}$	13.5	3.97	14.8	1.93	3.7	2.06	3.8	0.98	1.4	0.81	4.3	0.76
6×3½×$\frac{3}{8}$	11.7	3.42	12.9	1.94	3.3	2.04	3.3	0.99	1.2	0.79	3.8	0.77
6×3½×$\frac{5}{16}$	9.8	2.87	10.9	1.95	2.7	2.01	2.9	1.00	1.0	0.76	3.3	0.77
5×4×$\frac{7}{8}$	24.2	7.11	16.4	1.52	5.0	1.71	9.2	1.14	3.3	1.21	6.9	0.84
5×4×$\frac{13}{16}$	22.7	6.65	15.5	1.53	4.7	1.68	8.7	1.15	3.1	1.18	6.6	0.84
5×4×$\frac{3}{4}$	21.1	6.19	14.6	1.54	4.4	1.66	8.2	1.15	2.9	1.16	6.3	0.84
5×4×$\frac{11}{16}$	19.5	5.72	13.6	1.54	4.1	1.64	7.7	1.16	2.7	1.14	5.9	0.84
5×4×$\frac{5}{8}$	17.8	5.23	12.6	1.55	3.7	1.62	7.1	1.17	2.5	1.12	5.5	0.84
5×4×$\frac{9}{16}$	16.2	4.75	11.6	1.56	3.4	1.60	6.6	1.18	2.3	1.10	5.1	0.85
5×4×½	14.5	4.25	10.5	1.57	3.1	1.57	6.0	1.18	2.0	1.07	4.7	0.85
5×4×$\frac{7}{16}$	12.8	3.75	9.3	1.58	2.7	1.55	5.3	1.19	1.8	1.05	4.1	0.85
5×4×$\frac{3}{8}$	11.0	3.23	8.1	1.59	2.3	1.53	4.7	1.20	1.6	1.03	3.6	0.86

TABLE II—*Continued*

Elements of Angle with Unequal Legs



I = moment of inertia
J = product of inertia
r = radius of gyration

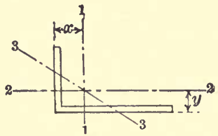


Size.	Weight per Foot.	Area of Section.	Axis 1–1.				Axis 2–2.				Axis 1–1 and 2–2.	Axis 3–3.
			I_1	r_1	$\frac{I_1}{l_1-x}$	x	I_2	r_2	$\frac{I_2}{l_2-y}$	y	J	r min.
Inches.	Pounds.	In.²	In.⁴	In.	In.³	In.	In.⁴	In.	In.³	In.	In.⁴	In.
$5 \times 3\frac{1}{2} \times \frac{7}{8}$	22.7	6.67	15.7	1.53	4.9	1.79	6.2	0.96	2.5	1.04	5.4	0.75
$5 \times 3\frac{1}{2} \times \frac{13}{16}$	21.3	6.25	14.8	1.54	4.6	1.77	5.9	0.97	2.4	1.02	5.1	0.75
$5 \times 3\frac{1}{2} \times \frac{3}{4}$	19.8	5.81	13.9	1.55	4.3	1.75	5.6	0.98	2.2	1.00	4.9	0.75
$5 \times 3\frac{1}{2} \times \frac{11}{16}$	18.3	5.37	13.0	1.56	4.0	1.72	5.2	0.98	2.1	0.97	4.6	0.75
$5 \times 3\frac{1}{2} \times \frac{5}{8}$	16.8	4.92	12.0	1.56	3.7	1.70	4.8	0.99	1.9	0.95	4.4	0.75
$5 \times 3\frac{1}{2} \times \frac{9}{16}$	15.2	4.47	11.0	1.57	3.3	1.68	4.4	1.00	1.7	0.93	4.0	0.75
$5 \times 3\frac{1}{2} \times \frac{1}{2}$	13.6	4.00	10.0	1.58	3.0	1.66	4.0	1.01	1.6	0.91	3.7	0.75
$5 \times 3\frac{1}{2} \times \frac{7}{16}$	12.0	3.53	8.9	1.59	2.6	1.63	3.6	1.01	1.4	0.88	3.3	0.76
$5 \times 3\frac{1}{2} \times \frac{3}{8}$	10.4	3.05	7.8	1.60	2.3	1.61	3.2	1.02	1.2	0.86	2.9	0.76
$5 \times 3\frac{1}{2} \times \frac{5}{16}$	8.7	2.56	6.6	1.61	1.9	1.59	2.7	1.03	1.0	0.84	2.5	0.76

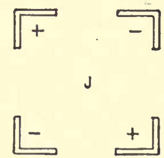
5 ×3 ×$\frac{13}{16}$	19.9	5.84	14.0	1.55	4.5	1.86	3.7	0.80	1.7	0.86	3.9	0.64
5 ×3 ×$\frac{3}{4}$	18.5	5.44	13.2	1.55	4.2	1.84	3.5	0.80	1.6	0.84	3.7	0.64
5 ×3 ×$\frac{11}{16}$	17.1	5.03	12.3	1.56	3.9	1.82	3.3	0.81	1.5	0.82	3.5	0.64
5 ×3 ×$\frac{5}{8}$	15.7	4.61	11.4	1.57	3.5	1.80	3.1	0.81	1.4	0.80	3.3	0.64
5 ×3 ×$\frac{9}{16}$	14.3	4.18	10.4	1.58	3.2	1.77	2.8	0.82	1.3	0.77	3.0	0.65
5 ×3 ×$\frac{1}{2}$	12.8	3.75	9.5	1.59	2.9	1.75	2.6	0.83	1.1	0.75	2.8	0.65
5 ×3 ×$\frac{7}{16}$	11.3	3.31	8.4	1.60	2.6	1.73	2.3	0.84	1.0	0.73	2.5	0.65
5 ×3 ×$\frac{3}{8}$	9.8	2.86	7.4	1.61	2.2	1.70	2.0	0.84	0.89	0.70	2.3	0.65
5 ×3 ×$\frac{5}{16}$	8.2	2.40	6.3	1.61	1.9	1.68	1.8	0.85	0.75	0.68	1.9	0.66
4$\frac{1}{2}$×3 ×$\frac{13}{16}$	18.5	5.43	10.3	1.38	3.6	1.65	3.6	0.81	1.7	0.90	3.3	0.64
4$\frac{1}{2}$×3 ×$\frac{3}{4}$	17.3	5.06	9.7	1.39	3.4	1.63	3.4	0.82	1.6	0.88	3.1	0.64
4$\frac{1}{2}$×3 ×$\frac{11}{16}$	16.0	4.68	9.1	1.39	3.1	1.60	3.2	0.83	1.5	0.85	2.9	0.64
4$\frac{1}{2}$×3 ×$\frac{5}{8}$	14.7	4.30	8.4	1.40	2.9	1.58	3.0	0.83	1.4	0.83	2.8	0.64
4$\frac{1}{2}$×3 ×$\frac{9}{16}$	13.3	3.90	7.8	1.41	2.6	1.56	2.8	0.85	1.3	0.81	2.6	0.64
4$\frac{1}{2}$×3 ×$\frac{1}{2}$	11.9	3.50	7.0	1.42	2.4	1.54	2.5	0.85	1.1	0.79	2.4	0.65
4$\frac{1}{2}$×3 ×$\frac{7}{16}$	10.6	3.09	6.3	1.43	2.1	1.51	2.3	0.85	1.0	0.76	2.1	0.65
4$\frac{1}{2}$×3 ×$\frac{3}{8}$	9.1	2.67	5.5	1.44	1.8	1.49	2.0	0.86	0.88	0.74	1.9	0.66
4$\frac{1}{2}$×3 ×$\frac{5}{16}$	7.7	2.25	4.7	1.44	1.5	1.47	1.7	0.87	0.75	0.72	1.6	0.66
4 ×3$\frac{1}{2}$×$\frac{13}{16}$	18.5	5.43	7.8	1.19	2.9	1.36	5.5	1.01	2.3	1.11	3.6	0.72
4 ×3$\frac{1}{2}$×$\frac{3}{4}$	17.3	5.06	7.3	1.20	2.8	1.34	5.2	1.01	2.1	1.09	3.4	0.72
4 ×3$\frac{1}{2}$×$\frac{11}{16}$	16.0	4.68	6.9	1.21	2.6	1.32	4.9	1.02	2.0	1.07	3.2	0.72
4 ×3$\frac{1}{2}$×$\frac{5}{8}$	14.7	4.30	6.4	1.22	2.4	1.29	4.5	1.03	1.8	1.04	3.0	0.72
4 ×3$\frac{1}{2}$×$\frac{9}{16}$	13.3	3.90	5.9	1.23	2.1	1.27	4.2	1.03	1.7	1.02	2.8	0.72
4 ×3$\frac{1}{2}$×$\frac{1}{2}$	11.9	3.50	5.3	1.23	1.9	1.25	3.8	1.04	1.5	1.00	2.6	0.72
4 ×3$\frac{1}{2}$×$\frac{7}{16}$	10.6	3.09	4.8	1.24	1.7	1.23	3.4	1.05	1.3	0.98	2.3	0.72
4 ×3$\frac{1}{2}$×$\frac{3}{8}$	9.1	2.67	4.2	1.25	1.5	1.21	3.0	1.06	1.2	0.96	2.1	0.73
4 ×3$\frac{1}{2}$×$\frac{5}{16}$	7.7	2.25	3.6	1.26	1.3	1.18	2.6	1.07	1.0	0.93	1.8	0.73

TABLE II—*Continued*

Elements of Angles with Unequal Legs



I = moment of inertia
J = product of inertia
r = radius of gyration

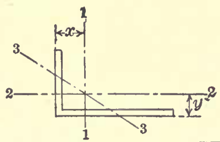


Size.	Weight per Foot.	Area of Section.	Axis 1–1.				Axis 2–2.				Axis 1–1 and 2–2.	Axis 3–3.
			I_1	r_1	$\frac{I_1}{l_1-x}$	x	I_2	r_2	$\frac{I_2}{l_2-y}$	y	J	r min.
Inches.	Pounds.	In.^{2}	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.
$4 \times 3 \times \frac{13}{16}$	17.1	5.03	7.3	1.21	2.9	1.44	3.5	0.83	1.7	0.94	2.7	0.64
$4 \times 3 \times \frac{3}{4}$	16.0	4.69	6.9	1.22	2.7	1.42	3.3	0.84	1.6	0.92	2.6	0.64
$4 \times 3 \times \frac{11}{16}$	14.8	4.34	6.5	1.22	2.5	1.39	3.1	0.84	1.5	0.89	2.5	0.64
$4 \times 3 \times \frac{5}{8}$	13.6	3.98	6.0	1.23	2.3	1.37	2.9	0.85	1.4	0.87	2.4	0.64
$4 \times 3 \times \frac{9}{16}$	12.4	3.62	5.6	1.24	2.1	1.35	2.7	0.86	1.2	0.85	2.2	0.64
$4 \times 3 \times \frac{1}{2}$	11.1	3.25	5.0	1.25	1.9	1.33	2.4	0.86	1.1	0.83	2.0	0.64
$4 \times 3 \times \frac{7}{16}$	9.8	2.87	4.5	1.25	1.7	1.30	2.2	0.87	1.0	0.80	1.8	0.64
$4 \times 3 \times \frac{3}{8}$	8.5	2.48	4.0	1.26	1.5	1.28	1.9	0.88	0.87	0.78	1.6	0.64
$4 \times 3 \times \frac{5}{16}$	7.2	2.09	3.4	1.27	1.2	1.26	1.7	0.89	0.74	0.76	1.4	0.65
$4 \times 3 \times \frac{1}{4}$	5.8	1.69	2.8	1.28	1.0	1.24	1.4	0.89	0.60	0.74	1.1	0.65

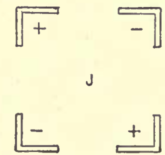
$3\frac{1}{2}\times3\times\frac{13}{16}$	15.8	4.62	5.0	1.04	2.2	1.23	3.3	0.85	1.7	0.98	2.2	0.62
$3\frac{1}{2}\times3\times\frac{3}{4}$	14.7	4.31	4.7	1.04	2.1	1.21	3.1	0.85	1.5	0.96	2.1	0.62
$3\frac{1}{2}\times3\times\frac{11}{16}$	13.6	4.00	4.4	1.05	1.9	1.19	3.0	0.86	1.4	0.94	2.0	0.62
$3\frac{1}{2}\times3\times\frac{5}{8}$	12.5	3.67	4.1	1.06	1.8	1.17	2.8	0.87	1.3	0.92	1.9	0.62
$3\frac{1}{2}\times3\times\frac{9}{16}$	11.4	3.34	3.8	1.07	1.6	1.15	2.5	0.87	1.2	0.90	1.7	0.62
$3\frac{1}{2}\times3\times\frac{1}{2}$	10.2	3.00	3.5	1.07	1.5	1.13	2.3	0.88	1.1	0.88	1.6	0.62
$3\frac{1}{2}\times3\times\frac{7}{16}$	9.1	2.65	3.1	1.08	1.3	1.10	2.1	0.89	0.98	0.85	1.5	0.62
$3\frac{1}{2}\times3\times\frac{3}{8}$	7.9	2.30	2.7	1.09	1.1	1.08	1.8	0.90	0.85	0.83	1.3	0.62
$3\frac{1}{2}\times3\times\frac{5}{16}$	6.6	1.93	2.3	1.10	0.96	1.06	1.6	0.90	0.72	0.81	1.1	0.63
$3\frac{1}{2}\times3\times\frac{1}{4}$	5.4	1.56	1.9	1.11	0.78	1.04	1.3	0.91	0.58	0.79	0.92	0.63
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{11}{16}$	12.5	3.65	4.1	1.06	1.9	1.27	1.7	0.69	0.99	0.77	1.4	0.53
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{5}{8}$	11.5	3.36	3.8	1.07	1.7	1.25	1.6	0.69	0.92	0.75	1.4	0.53
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{9}{16}$	10.4	3.06	3.6	1.08	1.6	1.23	1.5	0.70	0.84	0.73	1.3	0.53
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{2}$	9.4	2.75	3.2	1.09	1.4	1.20	1.4	0.70	0.76	0.70	1.2	0.53
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{7}{16}$	8.3	2.43	2.9	1.09	1.3	1.18	1.2	0.71	0.68	0.68	1.1	0.54
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{8}$	7.2	2.11	2.6	1.10	1.1	1.16	1.1	0.72	0.59	0.66	0.97	0.54
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{5}{16}$	6.1	1.78	2.2	1.11	0.93	1.14	0.94	0.73	0.50	0.64	0.84	0.54
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{4}$	4.9	1.44	1.8	1.12	0.75	1.11	0.78	0.74	0.41	0.61	0.71	0.54
$3\times2\frac{1}{2}\times\frac{9}{16}$	9.5	2.78	2.3	0.91	1.2	1.02	1.4	0.72	0.82	0.77	1.02	0.52
$3\times2\frac{1}{2}\times\frac{1}{2}$	8.5	2.50	2.1	0.91	1.0	1.00	1.3	0.72	0.74	0.75	0.94	0.52
$3\times2\frac{1}{2}\times\frac{7}{16}$	7.6	2.21	1.9	0.92	0.93	0.98	1.2	0.73	0.66	0.73	0.84	0.52
$3\times2\frac{1}{2}\times\frac{3}{8}$	6.6	1.92	1.7	0.93	0.81	0.96	1.0	0.74	0.58	0.71	0.75	0.52
$3\times2\frac{1}{2}\times\frac{5}{16}$	5.6	1.62	1.4	0.94	0.69	0.93	0.90	0.74	0.49	0.68	0.65	0.53
$3\times2\frac{1}{2}\times\frac{1}{4}$	4.5	1.31	1.2	0.95	0.56	0.91	0.74	0.75	0.40	0.66	0.55	0.53

TABLE II—*Concluded*

Elements of Angles with Unequal Legs



I = moment of inertia
J = product of inertia
r = radius of gyration

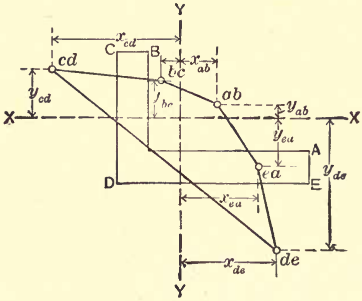


Size.	Weight per Foot.	Area of Section.	Axis 1–1.				Axis 2–2.				Axis 1–1 and 2–2.	Axis 3–3.
			I_1	r_1	$\frac{I_1}{l_1-x}$	x	I_2	r_2	$\frac{I_2}{l_2-y}$	y	J	r min.
Inches.	Pounds.	In.^{2}	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.	In.^{3}	In.	In.^{4}	In.
$3 \times 2 \times \frac{1}{2}$	7.7	2.25	1.9	0.92	1.0	1.08	0.67	0.55	0.47	0.58	0.64	0.43
$3 \times 2 \times \frac{7}{16}$	6.8	2.00	1.7	0.93	0.89	1.06	0.61	0.55	0.42	0.56	0.57	0.43
$3 \times 2 \times \frac{3}{8}$	5.9	1.73	1.5	0.94	0.78	1.04	0.54	0.56	0.37	0.54	0.51	0.43
$3 \times 2 \times \frac{5}{16}$	5.0	1.47	1.3	0.95	0.66	1.02	0.47	0.57	0.32	0.52	0.45	0.43
$3 \times 2 \times \frac{1}{4}$	4.1	1.19	1.1	0.95	0.54	0.99	0.39	0.57	0.25	0.49	0.39	0.43
$2\frac{1}{2} \times 2 \times \frac{1}{2}$	6.8	2.00	1.1	0 75	0.70	0.88	0.64	0.56	0.46	0.63	0.46	0.42
$2\frac{1}{2} \times 2 \times \frac{7}{16}$	6.1	1.78	1.0	0.76	0.62	0.85	0.58	0.57	0.41	0.60	0.43	0.42
$2\frac{1}{2} \times 2 \times \frac{3}{8}$	5.3	1.55	0.91	0.77	0.55	0.83	0.51	0.58	0.36	0.58	0.40	0.42
$2\frac{1}{2} \times 2 \times \frac{5}{16}$	4.5	1.31	0.79	0.78	0.47	0.81	0.45	0.58	0.31	0.56	0.34	0.42
$2\frac{1}{2} \times 2 \times \frac{1}{4}$	3.62	1.06	0.65	0.78	0.38	0.79	0.37	0.59	0.25	0.54	0.28	0.42
$2\frac{1}{2} \times 2 \times \frac{3}{16}$	2.75	0.81	0.51	0.79	0.29	0.76	0.29	0.60	0.20	0.51	0.22	0.43
$2\frac{1}{2} \times 2 \times \frac{1}{8}$	1.86	0.55	0.35	0.80	0.20	0.74	0.20	0.61	0.13	0.49	0.16	0.43

$2\frac{1}{2}\times1\frac{1}{2}\times\frac{5}{16}$	3.92	1.15	0.71	0.79	0.44	0.90	0.19	0.41	0.17	0.40	0.20	0.32
$2\frac{1}{2}\times1\frac{1}{2}\times\frac{1}{4}$	3.19	0.94	0.59	0.79	0.36	0.88	0.16	0.41	0.14	0.38	0.17	0.32
$2\frac{1}{2}\times1\frac{1}{2}\times\frac{3}{16}$	2.44	0.72	0.46	0.80	0.28	0.85	0.13	0.42	0.11	0.35	0.14	0.33
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{1}{2}$	5.6	1.63	0.75	0.68	0.54	0.86	0.26	0.40	0.26	0.48	0.22	0.32
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{7}{16}$	5.0	1.45	0.68	0.69	0.48	0.83	0.24	0.41	0.23	0.46	0.21	0.32
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{3}{8}$	4.4	1.27	0.61	0.69	0.42	0.81	0.21	0.41	0.20	0.44	0.20	0.32
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{5}{16}$	3.66	1.07	0.53	0.70	0.36	0.79	0.19	0.42	0.17	0.42	0.17	0.32
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{1}{4}$	2.98	0.88	0.44	0.71	0.30	0.77	0.16	0.42	0.14	0.39	0.15	0.32
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{3}{16}$	2.28	0.67	0.34	0.72	0.23	0.75	0.12	0.43	0.11	0.37	0.12	0.33

TABLE III

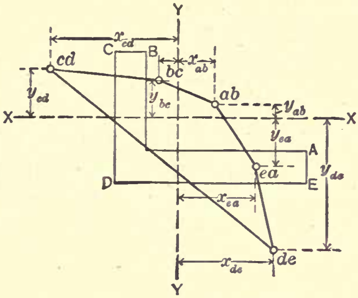
Coordinates of Section Modulus Polygons for Angles



Size of Angle.	Coordinates.									
	x_{ab} +	y_{ab} +	x_{bc} −	y_{bc} +	x_{cd} −	y_{cd} +	x_{de} +	y_{de} −	x_{ea} +	y_{ea} −
8×8×1⅛	9.45	9.45	10.25	17.53	40.66	23.78	23.78	40.66	17.53	10.25
8×8×1	8.66	8.66	9.25	15.81	37.55	21.98	21.98	37.55	15.81	9.25
8×8×⅞	7.67	7.67	8.29	14.01	34.31	20.30	20.30	34.31	14.01	8.29
8×8×¾	6.80	6.80	7.20	12.18	30.57	18.07	18.07	30.57	12.18	7.20
8×8×⅝	5.76	5.76	6.13	10.29	26.64	15.87	15.87	26.64	10.29	6.13
8×8×½	4.78	4.78	4.97	8.36	22.19	13.20	13.20	22.19	8.36	4.97
8×6×1	7.95	4.91	7.47	8.92	30.49	12.26	19.70	23.51	15.39	6.07
8×6×⅞	7.33	4.47	6.65	7.95	27.70	11.19	18.14	21.68	13.41	5.42
8×6×¾	6.36	3.79	5.86	6.91	24.77	10.16	16.67	19.68	11.65	4.78
8×6×⅝	5.56	3.27	4.96	5.87	21.47	8.81	14.60	17.30	9.87	4.05
8×6×½	4.57	2.66	4.06	4.79	17.39	7.45	12.52	14.76	8.01	3.33
8×6×7/16	4.08	2.38	3.58	4.24	16.00	6.65	11.24	13.31	7.06	2.94
8×3½×1	6.76	2.15	4.50	3.02	20.88	3.66	12.61	8.48	13.71	2.40
8×3½×⅞	6.15	1.73	4.11	2.70	19.04	3.46	12.41	8.16	12.17	2.21
8×3½×¾	5.58	1.43	3.66	2.35	17.04	3.19	11.95	7.68	10.61	1.99
8×3½×⅝	5.06	1.19	3.09	1.98	14.75	2.77	10.77	6.92	8.99	1.69
8×3½×½	4.26	0.93	2.56	1.62	12.31	2.38	9.73	6.16	7.31	1.41
8×3½×7/16	3.79	0.85	2.29	1.46	11.02	2.17	9.14	5.86	6.44	1.27
7×3½×1	5.07	1.88	3.82	2.95	16.75	3.58	10.10	7.81	10.60	2.26
7×3½×⅞	4.65	1.61	3.61	2.63	15.35	3.38	9.89	7.47	9.41	2.07
7×3½×¾	4.28	1.40	3.08	2.32	13.75	3.09	9.32	7.01	8.22	1.87
7×3½×⅝	3.79	1.16	2.65	1.98	12.02	2.66	8.66	6.46	7.13	1.60
7×3½×½	3.27	0.94	2.17	1.62	10.05	2.33	7.06	5.64	5.68	1.32
7×3½×⅜	2.56	0.72	1.70	1.26	7.90	1.90	6.44	4.80	4.34	1.04

TABLE III—*Continued*

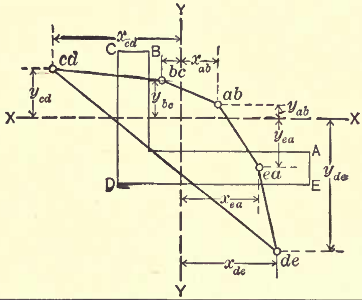
Coordinates of Section Modulus Polygons for Angles



Size of Angle.	x_{ab} +	y_{ab} +	x_{bc} −	y_{bc} +	x_{cd} −	y_{cd} +	x_{de} +	y_{de} −	x_{ea} +	y_{ea} −
	Coordinates.									
$6\times6\times1$	4.54	4.54	4.98	8.57	19.10	11.08	11.08	19.10	8.57	4.98
$6\times6\times\frac{7}{8}$	4.11	4.11	4.45	7.64	17.54	10.21	10.21	17.54	7.64	4.45
$6\times6\times\frac{3}{4}$	3.70	3.70	3.89	6.59	15.86	9.23	9.23	15.86	6.59	3.89
$6\times6\times\frac{5}{8}$	3.13	3.13	3.35	5.67	14.00	8.26	8.26	14.00	5.67	3.35
$6\times6\times\frac{1}{2}$	2.55	2.55	2.75	4.61	11.84	7.08	7.08	11.84	4.61	2.75
$6\times6\times\frac{3}{8}$	2.00	2.00	2.11	3.53	9.40	5.61	5.61	9.40	3.53	2.11
$6\times4\times1$	4.03	2.28	3.50	3.82	14.20	4.56	8.46	9.23	8.05	2.58
$6\times4\times\frac{7}{8}$	3.58	1.95	3.23	3.40	13.06	4.38	8.30	8.75	7.23	2.40
$6\times4\times\frac{3}{4}$	3.27	1.70	2.84	2.98	11.78	3.99	7.68	8.05	6.25	2.12
$6\times4\times\frac{5}{8}$	2.85	1.40	2.46	2.53	10.40	3.60	7.09	7.28	5.32	1.84
$6\times4\times\frac{1}{2}$	2.46	1.20	1.99	2.09	8.74	3.02	6.06	6.36	4.33	1.50
$6\times4\times\frac{3}{8}$	1.90	0.88	1.57	1.60	6.96	2.47	5.11	5.21	3.32	1.18
$6\times3\frac{1}{2}\times1$	3.66	1.77	3.13	2.89	12.92	3.45	7.72	7.12	7.81	2.08
$6\times3\frac{1}{2}\times\frac{7}{8}$	3.43	1.58	2.84	2.61	11.89	3.24	7.42	6.80	6.99	1.90
$6\times3\frac{1}{2}\times\frac{3}{4}$	3.19	1.34	2.49	2.26	10.69	2.94	6.88	6.24	6.10	1.68
$6\times3\frac{1}{2}\times\frac{5}{8}$	2.78	1.13	2.18	1.95	9.44	2.68	6.48	5.80	5.20	1.47
$6\times3\frac{1}{2}\times\frac{1}{2}$	2.35	0.93	1.80	1.61	7.98	2.31	5.78	5.18	4.24	1.22
$6\times3\frac{1}{2}\times\frac{3}{8}$	1.89	0.66	1.40	1.22	6.32	1.86	4.81	4.18	3.26	0.96
$6\times3\frac{1}{2}\times\frac{5}{16}$	1.57	0.59	1.20	1.06	5.42	1.64	4.34	3.82	2.73	0.83
$5\times5\times1$	3.06	3.06	3.27	5.78	12.18	6.90	6.90	12.18	5.78	3.27
$5\times5\times\frac{7}{8}$	2.81	2.81	2.94	5.20	11.33	6.44	6.44	11.33	5.20	2.94
$5\times5\times\frac{3}{4}$	2.40	2.40	2.64	4.51	10.32	6.05	6.05	10.32	4.51	2.64
$5\times5\times\frac{5}{8}$	2.10	2.10	2.27	3.84	9.20	5.40	5.40	9.20	3.84	2.27
$5\times5\times\frac{1}{2}$	1.74	1.74	1.88	3.16	7.90	4.69	4.69	7.90	3.16	1.88
$5\times5\times\frac{3}{8}$	1.27	1.27	1.50	2.41	6.25	3.88	3.88	6.25	2.41	1.50

TABLE III—*Continued*

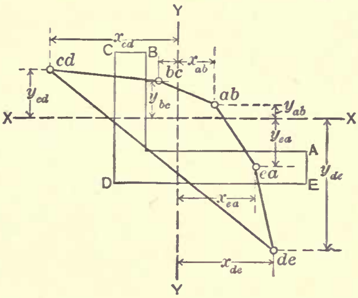
Coordinates of Section Modulus Polygons for Angles



Size of Angle.	Coordinates.									
	x_{ab} +	y_{ab} +	x_{bc} −	y_{bc} +	x_{cd} −	y_{cd} +	x_{de} +	y_{de} −	x_{ea} +	y_{ea} −
5×4×⅞	2.56	1.84	2.47	3.30	9.59	4.04	5.70	7.60	4.99	2.10
5×4×¾	2.27	1.58	2.22	2.88	8.80	3.80	5.43	7.07	4.37	1.89
5×4×⅝	2.00	1.35	1.91	2.46	7.78	3.40	4.91	6.34	3.72	1.63
5×4×½	1.65	1.12	1.60	2.05	6.68	2.99	4.39	5.60	3.06	1.37
5×4×⅜	1.33	0.91	1.21	1.58	5.30	2.35	3.50	4.56	2.33	1.04
5×3½×⅞	2.44	1.48	2.19	2.52	8.77	3.02	5.19	5.96	4.89	1.68
5×3½×¾	2.21	1.31	1.96	2.24	7.94	2.80	4.90	5.60	4.27	1.51
5×3½×⅝	1.89	1.03	1.72	1.88	7.06	2.59	4.63	5.06	3.63	1.33
5×3½×½	1.63	0.84	1.43	1.54	6.02	2.23	4.06	4.40	3.00	1.11
5×3½×⅜	1.31	0.69	1.10	1.21	4.84	1.80	3.37	3.72	2.30	0.86
5×3½×5/16	1.11	0.56	0.94	1.02	4.14	1.57	2.98	3.22	1.93	0.73
5×3×13/16	2.14	1.04	1.82	1.73	7.52	2.10	4.53	4.30	4.46	1.24
5×3×¾	2.08	0.97	1.71	1.62	7.18	2.01	4.40	4.16	4.17	1.17
5×3×⅝	1.85	0.84	1.50	1.41	6.34	1.83	4.12	3.88	3.56	1.03
5×3×½	1.59	0.67	1.24	1.16	5.42	1.60	3.73	3.47	2.92	0.86
5×3×⅜	1.23	0.45	1.00	0.87	4.35	1.36	3.29	2.86	2.24	0.70
5×3×5/16	1.11	0.40	0.82	0.78	3.75	1.13	2.80	2.64	1.90	0.57
4½×3×13/16	1.75	1.02	1.57	1.72	6.24	2.00	3.67	4.00	3.62	1.16
4½×3×¾	1.71	0.97	1.46	1.60	5.95	1.90	3.53	3.87	3.38	1.08
4½×3×⅝	1.42	0.81	1.29	1.38	5.31	1.77	3.38	3.62	2.88	0.96
4½×3×½	1.27	0.64	1.09	1.13	4.54	1.56	3.04	3.17	2.37	0.81
4½×3×⅜	1.03	0.51	0.84	0.88	3.69	1.27	2.57	2.70	1.83	0.63
4½×3×5/16	0.92	0.44	0.70	0.75	3.20	1.09	2.22	2.36	1.54	0.53

TABLE III—*Continued*

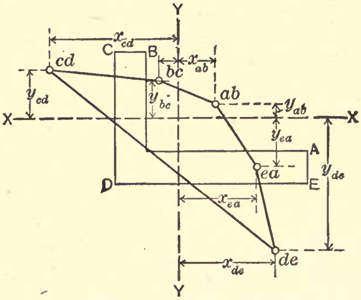
Coordinates of Section Modulus Polygons for Angles



Size of Angle.	Coordinates.									
	x_{ab} +	y_{ab} +	x_{bc} −	y_{bc} +	x_{cd} −	y_{cd} +	x_{de} +	y_{de} −	x_{ea} +	y_{ea} −
$4\times4\times\frac{13}{16}$	1.57	1.57	1.70	2.99	6.28	3.57	3.57	6.28	2.99	1.70
$4\times4\times\frac{3}{4}$	1.49	1.49	1.61	2.82	6.06	3.47	3.47	6.06	2.82	1.61
$4\times4\times\frac{5}{8}$	1.34	1.34	1.37	2.42	5.44	3.09	3.09	5.44	2.42	1.37
$4\times4\times\frac{1}{2}$	1.12	1.12	1.13	1.99	4.74	2.71	2.71	4.74	1.99	1.13
$4\times4\times\frac{3}{8}$	0.86	0.86	0.91	1.54	3.86	2.28	2.28	3.86	1.54	0.91
$4\times4\times\frac{1}{4}$	0.58	0.58	0.62	1.03	2.76	1.66	1.66	2.76	1.03	0.62
$4\times3\frac{1}{2}\times\frac{13}{16}$	1.54	1.28	1.51	2.30	5.74	2.65	3.24	4.96	2.96	1.36
$4\times3\frac{1}{2}\times\frac{3}{4}$	1.50	1.22	1.41	2.16	5.45	2.54	3.12	4.77	2.74	1.28
$4\times3\frac{1}{2}\times\frac{5}{8}$	1.24	0.98	1.26	1.83	4.96	2.40	2.98	4.33	2.36	1.14
$4\times3\frac{1}{2}\times\frac{1}{2}$	1.05	0.85	1.04	1.52	4.24	2.08	2.60	3.80	1.93	0.95
$4\times3\frac{1}{2}\times\frac{3}{8}$	0.83	0.65	0.83	1.18	3.47	1.73	2.19	3.12	1.50	0.75
$4\times3\frac{1}{2}\times\frac{5}{16}$	0.72	0.57	0.70	1.01	3.05	1.53	1.93	2.80	1.28	0.64
$4\times3\times\frac{13}{16}$	1.42	1.01	1.31	1.70	5.07	1.87	2.87	3.72	2.85	1.06
$4\times3\times\frac{3}{4}$	1.35	0.93	1.25	1.59	4.86	1.83	2.83	3.59	2.57	1.01
$4\times3\times\frac{5}{8}$	1.13	0.75	1.13	1.36	4.38	1.75	2.76	3.33	3.28	0.91
$4\times3\times\frac{1}{2}$	1.00	0.62	0.92	1.10	3.76	1.50	2.41	2.89	1.87	0.75
$4\times3\times\frac{3}{8}$	0.83	0.47	0.72	0.86	3.12	1.25	2.05	2.43	1.47	0.59
$4\times3\times\frac{1}{4}$	0.57	0.37	0.49	0.62	2.26	0.89	1.49	1.89	1.01	0.40
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{13}{16}$	1.22	1.22	1.24	2.27	4.53	2.48	2.48	4.53	2.27	1.24
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{3}{4}$	1.13	1.13	1.19	2.13	4.35	2.43	2.43	4.35	2.13	1.19
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{5}{8}$	0.93	0.93	1.04	1.79	3.91	2.27	2.27	3.91	1.79	1.04
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{1}{2}$	0.80	0.80	0.86	1.48	3.40	1.98	1.98	3.40	1.48	0.86
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{3}{8}$	0.65	0.65	0.68	1.16	2.87	1.68	1.68	2.87	1.16	0.68
$3\frac{1}{2}\times3\frac{1}{2}\times\frac{1}{4}$	0.44	0.44	0.47	0.79	2.06	1.24	1.24	2.06	0.79	0.47

TABLE III—*Continued*

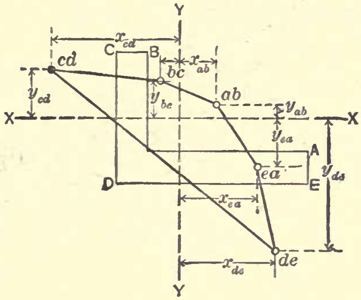
Coordinates of Section Modulus Polygons for Angles



Size of Angle.	Coordinates.									
	x_{ab} +	y_{ab} +	x_{bc} −	y_{bc} +	x_{cd} −	y_{cd} +	x_{de} +	y_{de} −	x_{ea} +	y_{ea} −
$3\frac{1}{2}\times3\times\frac{13}{16}$	1.11	0.90	1.09	1.63	4.06	1.79	2.24	3.37	2.20	0.97
$3\frac{1}{2}\times3\times\frac{3}{4}$	1.05	0.83	1.03	1.52	3.89	1.74	2.19	3.23	2.06	0.92
$3\frac{1}{2}\times3\times\frac{5}{8}$	0.91	0.75	0.91	1.34	3.51	1.62	2.07	3.04	1.76	0.82
$3\frac{1}{2}\times3\times\frac{1}{2}$	0.82	0.61	0.75	1.08	3.10	1.41	1.82	2.61	1.48	0.68
$3\frac{1}{2}\times3\times\frac{3}{8}$	0.61	0.45	0.60	0.83	2.50	1.20	1.57	2.17	1.11	0.54
$3\frac{1}{2}\times3\times\frac{1}{4}$	0.45	0.34	0.42	0.59	1.83	0.88	1.16	1.64	0.77	0.37
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{11}{16}$	0.85	0.59	0.85	0.98	3.23	1.18	1.90	2.21	1.84	0.65
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{5}{8}$	0.80	0.51	0.80	0.91	3.04	1.12	1.87	2.13	1.69	0.62
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{2}$	0.70	0.45	0.67	0.78	2.67	1.00	1.72	2.00	1.39	0.52
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{8}$	0.61	0.34	0.53	0.60	2.24	0.84	1.47	1.67	1.11	0.41
$3\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{4}$	0.41	0.22	0.38	0.41	1.62	0.64	1.16	1.28	0.75	0.29
$3\times3\times\frac{5}{8}$	0.66	0.66	0.74	1.29	2.65	1.53	1.53	2.65	1.29	0.74
$3\times3\times\frac{1}{2}$	0.55	0.55	0.63	1.06	2.36	1.40	1.40	2.36	1.06	0.63
$3\times3\times\frac{3}{8}$	0.50	0.50	0.47	0.85	2.02	1.12	1.12	2.02	0.85	0.47
$3\times3\times\frac{1}{4}$	0.29	0.29	0.35	0.55	1.43	0.89	0.89	1.43	0.55	0.35
$3\times2\frac{1}{2}\times\frac{9}{16}$	0.59	0.43	0.59	0.81	2.26	1.00	1.32	1.82	1.16	0.51
$3\times2\frac{1}{2}\times\frac{1}{2}$	0.55	0.41	0.54	0.74	2.10	0.94	1.25	1.73	1.05	0.47
$3\times2\frac{1}{2}\times\frac{3}{8}$	0.48	0.30	0.42	0.56	1.77	0.78	1.06	1.41	0.83	0.37
$3\times2\frac{1}{2}\times\frac{1}{4}$	0.33	0.21	0.30	0.40	1.32	0.60	0.83	1.12	0.57	0.26
$3\times2\times\frac{1}{2}$	0.47	0.27	0.45	0.47	1.76	0.59	1.10	1.16	0.99	0.33
$3\times2\times\frac{3}{8}$	0.40	0.21	0.35	0.37	1.44	0.49	0.94	1.00	0.77	0.26
$3\times2\times\frac{1}{4}$	0.30	0.14	0.26	0.26	1.11	0.39	0.80	0.80	0.55	0.19

TABLE III—*Concluded*

Coordinates of Section Modulus Polygons for Angles

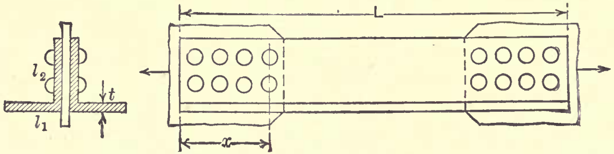


Size of Angle.	x_{ab} +	y_{ab} +	x_{bc} −	y_{bc} +	x_{cd} −	y_{cd} +	x_{de} +	y_{de} −	x_{ea} +	y_{ea} −
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{2}$	0.38	0.38	0.40	0.71	1.48	0.84	0.84	1.48	0.71	0.40
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{8}$	0.30	0.30	0.33	0.56	1.29	0.75	0.75	1.29	0.56	0.33
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{4}$	0.22	0.22	0.23	0.39	0.97	0.57	0.57	0.97	0.39	0.23
$2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{8}$	0.11	0.11	0.13	0.21	0.57	0.34	0.34	0.57	0.21	0.13
$2\frac{1}{2}\times2\times\frac{1}{2}$	0.34	0.27	0.34	0.47	1.25	0.52	0.73	1.01	0.68	0.28
$2\frac{1}{2}\times2\times\frac{3}{8}$	0.28	0.19	0.28	0.36	1.10	0.48	0.69	0.88	0.54	0.24
$2\frac{1}{2}\times2\times\frac{1}{4}$	0.22	0.15	0.19	0.25	0.82	0.35	0.52	0.68	0.38	0.16
$2\frac{1}{2}\times2\times\frac{1}{8}$	0.11	0.07	0.11	0.13	0.47	0.22	0.33	0.41	0.20	0.09
$2\frac{1}{2}\times1\frac{1}{2}\times\frac{5}{16}$	0.24	0.10	0.18	0.17	0.79	0.22	0.50	0.47	0.44	0.12
$2\frac{1}{2}\times1\frac{1}{2}\times\frac{1}{4}$	0.20	0.08	0.15	0.14	0.67	0.19	0.45	0.42	0.36	0.10
$2\frac{1}{2}\times1\frac{1}{2}\times\frac{3}{16}$	0.16	0.06	0.12	0.11	0.54	0.16	0.40	0.37	0.28	0.08
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{1}{2}$	0.26	0.16	0.22	0.25	0.87	0.26	0.48	0.54	0.54	0.16
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{3}{8}$	0.21	0.12	0.19	0.20	0.75	0.25	0.45	0.48	0.42	0.14
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{1}{4}$	0.16	0.09	0.14	0.14	0.57	0.19	0.38	0.41	0.30	0.10
$2\frac{1}{4}\times1\frac{1}{2}\times\frac{3}{16}$	0.12	0.06	0.11	0.11	0.45	0.16	0.32	0.32	0.23	0.08
$2\times2\times\frac{7}{16}$	0.21	0.21	0.22	0.40	0.82	0.45	0.45	0.82	0.40	0.22
$2\times2\times\frac{3}{8}$	0.19	0.19	0.20	0.35	0.75	0.42	0.42	0.75	0.35	0.20
$2\times2\times\frac{1}{4}$	0.13	0.13	0.15	0.25	0.59	0.36	0.36	0.59	0.25	0.15
$2\times2\times\frac{1}{8}$	0.08	0.08	0.08	0.13	0.35	0.20	0.20	0.35	0.13	0.08

TABLE IV

EFFICIENCY AND ALLOWABLE TENSION FOR ANGLES RIVETED THROUGH ONE LEG TO A RIGID CONNECTION PLATE

Two Holes for $\frac{7}{8}$-inch Rivets Deducted from Connected Leg



Diameter of each hole = 1 inch.

Allowable stress = 16,000 lb. per sq.in.

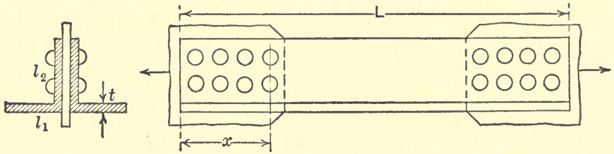
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
8	8	$1\frac{1}{8}$	61.7	65.1	69.0	73.5	78.5	84.2	10.32	10.89	11.54	12.30	13.13	14.09	165.1	174.2	184.6	196.8	210.1	225.4
		$1\frac{1}{16}$	61.6	65.1	69.0	73.5	78.5	84.2	9.78	10.33	10.95	11.66	12.46	13.36	156.5	165.3	175.2	186.6	199.4	213.8
		1	61.7	65.1	69.0	73.5	78.4	84.1	9.25	9.76	10.35	11.02	11.76	12.61	148.0	156.1	165.6	176.3	188.2	201.8
		$\frac{15}{16}$	61.7	65.1	69.0	73.5	78.4	84.1	8.71	9.19	9.74	10.38	11.07	11.87	139.3	147.0	155.8	166.1	177.1	189.9
		$\frac{7}{8}$	61.8	65.2	69.1	73.5	78.4	84.0	8.18	8.63	9.14	9.72	10.37	11.11	130.9	138.1	146.2	155.5	165.9	177.8
		$\frac{13}{16}$	61.8	65.3	69.1	73.5	78.4	84.0	7.63	8.06	8.53	9.07	9.67	10.37	122.1	129.0	136.5	145.1	154.7	165.9
		$\frac{3}{4}$	61.9	65.3	69.2	73.5	78.4	83.9	7.08	7.47	7.92	8.41	8.97	9.60	113.3	119.5	126.7	134.5	143.5	153.6
		$\frac{11}{16}$	61.9	65.3	69.2	73.5	78.3	83.9	6.52	6.88	7.29	7.74	8.24	8.83	104.3	110.1	116.6	123.8	131.8	141.3
		$\frac{5}{8}$	62.0	65.4	69.2	73.5	78.3	83.8	5.96	6.28	6.65	7.06	7.52	8.05	95.4	100.5	106.4	113.0	120.3	128.8
		$\frac{9}{16}$	62.0	65.4	69.3	73.5	78.3	83.8	5.38	5.68	6.01	6.38	6.80	7.27	86.1	90.9	96.2	102.1	108.8	116.3
		$\frac{1}{2}$	62.1	65.5	69.3	73.5	78.2	83.7	4.81	5.08	5.37	5.70	6.06	6.49	77.0	81.3	85.9	91.2	97.0	103.8

8	6	1	55.8	59.5	63.5	68.4	74.0	80.5	7.25	7.73	8.25	8.89	9.62	10.46	116.0	123.7	132.0	142.2	153.9	167.3
		$\frac{15}{16}$	55.9	59.5	63.6	68.4	74.0	80.5	6.85	7.29	7.79	8.38	9.06	9.86	109.6	116.6	124.6	134.1	145.0	157.8
		$\frac{7}{8}$	56.0	59.6	63.7	68.5	74.0	80.5	6.43	6.84	7.31	7.86	8.49	9.24	102.9	109.4	117.0	125.8	135.8	147.8
		$\frac{13}{16}$	56.1	59.7	63.7	68.5	74.0	80.4	6.01	6.40	6.83	7.34	7.93	8.62	96.2	102.4	109.3	117.4	126.9	137.9
		$\frac{3}{4}$	56.2	59.8	63.8	68.6	74.0	80.4	5.59	5.94	6.34	6.82	7.36	7.99	89.4	95.0	101.4	109.1	117.7	127.8
		$\frac{11}{16}$	56.2	59.8	63.8	68.6	74.0	80.4	5.14	5.47	5.84	6.28	6.77	7.36	82.2	87.5	93.4	100.5	108.3	117.7
		$\frac{5}{8}$	56.3	59.9	63.9	68.6	74.0	80.3	4.71	5.01	5.34	5.73	6.19	6.71	75.3	80.1	85.4	91.7	99.0	107.3
		$\frac{9}{16}$	56.4	59.9	63.9	68.7	74.0	80.3	4.26	4.53	4.83	5.19	5.59	6.07	68.1	72.5	77.3	83.0	89.4	97.1
		$\frac{1}{2}$	56.5	60.0	64.0	68.7	74.0	80.2	3.81	4.05	4.32	4.64	4.99	5.41	60.9	64.8	69.1	74.2	79.8	86.5
		$\frac{7}{16}$	56.6	60.0	64.0	68.7	74.0	80.2	3.35	3.56	3.79	4.07	4.39	4.76	53.6	56.9	60.6	65.1	70.2	76.1
6	8	1	63.4	66.5	69.9	73.7	77.8	82.5	8.24	8.64	9.09	9.58	10.11	10.72	131.8	138.2	145.4	153.3	161.8	171.5
		$\frac{15}{16}$	63.5	66.5	69.9	73.7	77.8	82.5	7.78	8.15	8.56	9.03	9.53	10.11	124.5	130.4	137.0	144.5	152.5	161.8
		$\frac{7}{8}$	63.6	66.6	69.9	73.7	77.8	82.4	7.30	7.65	8.02	8.46	8.93	9.46	116.8	122.4	128.3	135.3	142.9	151.4
		$\frac{13}{16}$	63.6	66.6	70.0	73.7	77.8	82.4	6.82	7.14	7.50	7.90	8.34	8.83	109.1	114.2	120.0	126.4	133.4	141.3
		$\frac{3}{4}$	63.7	66.7	70.0	73.7	77.8	82.3	6.33	6.63	6.96	7.33	7.73	8.18	101.3	106.1	111.4	117.3	123.7	130.9
		$\frac{11}{16}$	63.7	66.7	70.0	73.7	77.8	82.3	5.83	6.10	6.40	6.74	7.12	7.53	93.3	97.6	102.4	107.8	113.9	120.5
		$\frac{5}{8}$	63.8	66.8	70.1	73.7	77.8	82.3	5.33	5.58	5.83	6.16	6.50	6.88	85.3	89.3	93.3	98.5	104.0	110.1
		$\frac{9}{16}$	63.8	66.8	70.1	73.7	77.7	82.2	4.82	5.05	5.30	5.57	5.87	6.21	77.1	80.8	84.8	89.1	93.9	99.4
		$\frac{1}{2}$	63.9	66.9	70.2	73.7	77.7	82.2	4.31	4.52	4.74	4.97	5.24	5.55	69.0	72.3	75.8	79.5	83.8	88.8
		$\frac{7}{16}$	64.0	67.0	70.2	73.7	77.7	82.2	3.79	3.97	4.16	4.37	4.61	4.87	60.6	63.5	66.6	69.9	73.8	77.9

TABLE IV—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

Two Holes for $\frac{7}{8}$-inch Rivets Deducted from Connected Leg



Diameter of each hole = 1 inch.

Allowable stress = 16,000 lb. per sq.in.

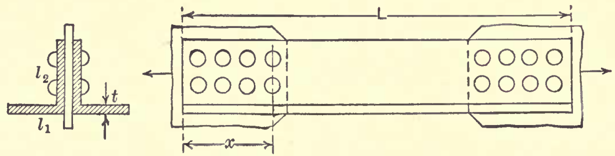
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Valves of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
6	6	1	56.8	60.1	63.7	67.9	72.6	78.1	6.25	6.61	7.01	7.47	7.99	8.59	100.0	105.8	112.1	119.5	127.8	137.4
		$\frac{15}{16}$	56.9	60.1	63.7	68.0	72.6	78.1	5.90	6.23	6.61	7.05	7.53	8.10	94.4	99.7	105.8	112.8	120.5	129.6
		$\frac{7}{8}$	57.0	60.2	63.8	68.0	72.6	78.0	5.55	5.86	6.21	6.62	7.06	7.59	88.8	93.8	99.4	105.9	113.0	121.4
		$\frac{13}{16}$	57.1	60.3	63.9	68.1	72.7	78.0	5.19	5.48	5.81	6.19	6.61	7.09	83.0	87.7	92.9	99.0	105.8	113.4
		$\frac{3}{4}$	57.2	60.4	64.0	68.1	72.7	78.0	4.83	5.10	5.40	5.75	6.14	6.58	77.3	81.6	86.4	92.0	98.2	105.3
		$\frac{11}{16}$	57.3	60.5	64.1	68.2	72.7	78.0	4.46	4.71	4.99	5.31	5.66	6.07	71.3	75.3	79.8	85.0	90.6	97.1
		$\frac{5}{8}$	57.4	60.6	64.2	68.2	72.8	78.0	4.08	4.31	4.56	4.85	5.18	5.55	65.3	68.9	72.9	77.6	82.9	88.8
		$\frac{9}{16}$	57.5	60.7	64.3	68.3	72.8	78.0	3.70	3.90	4.13	4.39	4.68	5.01	59.2	62.4	66.1	70.2	74.9	80.1
		$\frac{1}{2}$	57.7	60.8	64.4	68.4	72.9	78.0	3.32	3.50	3.70	3.93	4.19	4.48	53.1	56.0	59.2	62.9	67.0	71.7
		$\frac{7}{16}$	57.8	60.9	64.5	68.4	72.9	78.0	2.92	3.08	3.26	3.46	3.69	3.95	46.7	49.3	52.1	55.3	59.0	63.2
		$\frac{3}{8}$	57.9	61.0	64.6	68.5	73.0	78.0	2.52	2.66	2.82	2.99	3.18	3.40	40.3	42.5	45.1	47.8	50.9	54.4

4	6	$\frac{7}{8}$	58.5	61.2	64.1	67.3	71.0	75.0	4.67	4.88	5.11	5.37	5.67	5.98	74.7	78.1	81.8	85.9	90.7	95.7
		$\frac{13}{16}$	58.6	61.3	64.2	67.4	71.0	75.0	4.38	4.58	4.80	5.03	5.30	5.60	70.1	73.3	76.8	80.5	84.8	89.6
		$\frac{3}{4}$	58.7	61.4	64.3	67.5	71.0	75.0	4.07	4.26	4.46	4.68	4.93	5.20	65.1	68.1	71.3	74.9	78.9	83.2
		$\frac{11}{16}$	58.8	61.5	64.4	67.6	71.0	75.0	3.76	3.94	4.12	4.33	4.54	4.80	60.1	63.0	65.9	69.3	72.6	76.8
		$\frac{5}{8}$	59.0	61.7	64.5	67.7	71.1	75.0	3.46	3.62	3.78	3.97	4.17	4.39	55.3	57.9	60.5	63.5	66.7	70.2
		$\frac{9}{16}$	59.1	61.8	64.6	67.7	71.1	75.0	3.14	3.28	3.43	3.59	3.77	3.98	50.2	52.5	54.9	57.4	60.3	63.7
		$\frac{1}{2}$	59.2	61.9	64.7	67.8	71.2	75.0	2.81	2.94	3.07	3.22	3.38	3.56	44.9	47.0	49.1	51.5	54.0	56.9
		$\frac{7}{16}$	59.3	61.9	64.8	67.9	71.2	75.0	2.48	2.59	2.71	2.84	2.98	3.13	39.7	41.4	43.3	45.4	47.7	50.1
		$\frac{3}{8}$	59.4	62.0	64.9	68.0	71.3	75.0	2.14	2.20	2.34	2.45	2.57	2.71	34.2	35.2	37.4	39.2	41.1	43.3
$3\frac{1}{2}$	5	$\frac{5}{8}$	54.4	56.9	59.7	62.7	66.1	69.9	2.68	2.80	2.94	3.08	3.25	3.44	42.9	44.8	47.0	49.3	52.0	55.0
		$\frac{9}{16}$	54.5	57.0	59.8	62.8	66.2	70.0	2.44	2.55	2.67	2.81	2.96	3.13	39.0	40.8	42.7	44.9	47.3	50.1
		$\frac{1}{2}$	54.7	57.2	60.0	63.0	66.3	70.0	2.19	2.29	2.40	2.52	2.65	2.80	35.0	36.6	38.4	40.3	42.4	44.8
		$\frac{7}{16}$	54.8	57.3	60.1	63.1	66.3	70.0	1.93	2.02	2.12	2.23	2.34	2.47	30.9	32.3	33.9	35.7	37.4	39.5
		$\frac{3}{8}$	55.0	57.5	60.3	63.2	66.4	70.1	1.68	1.75	1.84	1.93	2.02	2.14	26.9	28.0	29.4	30.9	32.3	34.2
		$\frac{5}{16}$	55.1	57.6	60.4	63.3	66.5	70.1	1.41	1.47	1.55	1.62	1.70	1.79	22.5	23.5	24.8	25.9	27.2	28.6
3	5	$\frac{1}{2}$	55.0	57.3	59.8	62.5	65.5	68.8	2.06	2.15	2.24	2.34	2.46	2.58	32.9	34.4	35.8	37.4	39.3	41.3
		$\frac{7}{16}$	55.7	58.1	60.6	63.4	66.3	69.6	1.84	1.92	2.01	2.10	2.19	2.30	29.4	30.7	32.1	33.6	35.0	36.8
		$\frac{3}{8}$	56.5	58.9	61.5	64.2	67.2	70.5	1.62	1.66	1.76	1.84	1.92	2.01	25.9	26.5	28.1	29.4	30.7	32.1
		$\frac{5}{16}$	57.2	59.7	62.3	65.0	68.0	71.3	1.37	1.43	1.49	1.56	1.63	1.71	21.9	22.9	23.8	24.9	26.1	27.3

TABLE IV—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

Two Holes for $\frac{3}{4}$-inch Rivets Deducted from Connected Leg



Diameter of each hole = $\frac{7}{8}$ inch.

Allowable stress = 16,000 lb. per sq.in.

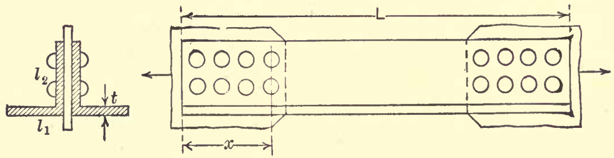
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. for One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
8	8	1	63.3	67.0	70.9	75.4	80.5	86.4	9.49	10.05	10.63	11.31	12.07	12.96	151.8	160.8	170.0	181.0	193.1	207.3
		$\frac{15}{16}$	63.3	67.0	70.9	75.4	80.5	86.3	8.94	9.46	10.01	10.50	11.37	12.18	143.0	151.3	160.1	168.0	181.9	194.9
		$\frac{7}{8}$	63.3	67.0	70.9	75.4	80.4	86.2	8.37	8.86	9.38	9.97	10.64	11.40	133.9	141.7	150.1	159.5	170.2	182.4
		$\frac{13}{16}$	63.4	67.0	70.9	75.3	80.4	86.1	7.82	8.27	8.75	9.29	9.92	10.62	125.1	132.3	140.0	148.6	158.7	169.9
		$\frac{3}{4}$	63.4	67.0	70.9	75.3	80.3	86.0	7.25	7.66	8.11	8.61	9.19	9.84	116.0	122.5	129.7	137.7	147.0	157.4
		$\frac{11}{16}$	63.4	67.0	70.9	75.3	80.3	86.0	6.68	7.06	7.47	7.93	8.46	9.06	106.9	113.0	119.5	126.9	135.3	145.0
		$\frac{5}{8}$	63.5	67.1	71.0	75.3	80.3	85.9	6.10	6.45	6.82	7.24	7.72	8.25	97.6	103.2	109.1	115.8	123.5	132.0
		$\frac{9}{16}$	63.5	67.1	71.0	75.3	80.3	85.9	5.51	5.82	6.16	6.54	6.97	7.46	88.2	93.1	98.5	104.6	111.5	119.3
		$\frac{1}{2}$	63.6	67.1	71.0	75.3	80.3	85.8	4.93	5.20	5.50	5.84	6.22	6.65	78.9	83.2	88.0	93.4	99.5	106.4

8	6	1	57.7	61.5	65.8	70.8	76.5	83.3	7.50	7.99	8.55	9.20	9.94	10.83	120.0	127.8	136.8	147.2	159.0	173.3
		$\frac{15}{16}$	57.8	61.6	65.8	70.8	76.5	83.2	7.08	7.55	8.06	8.67	9.37	10.19	113.3	120.8	128.9	138.7	149.9	163.0
		$\frac{7}{8}$	57.9	61.7	65.9	70.8	76.5	83.2	6.65	7.08	7.56	8.13	8.78	9.55	106.4	113.3	120.9	130.1	140.5	152.8
		$\frac{13}{16}$	58.0	61.7	65.9	70.8	76.5	83.1	6.22	6.61	7.06	7.59	8.20	8.91	99.5	105.7	112.9	121.4	131.2	142.5
		$\frac{3}{4}$	58.0	61.8	66.0	70.9	76.5	83.1	5.77	6.14	6.56	7.05	7.60	8.26	92.3	98.2	104.9	112.8	121.6	132.1
		$\frac{11}{16}$	58.1	61.8	66.0	70.9	76.5	83.0	5.32	5.65	6.04	6.49	7.00	7.59	85.1	90.4	96.6	103.8	112.0	121.4
		$\frac{5}{8}$	58.1	61.9	66.1	70.9	76.5	83.0	4.86	5.17	5.53	5.93	6.40	6.94	77.7	82.7	88.5	94.9	102.4	111.0
		$\frac{9}{16}$	58.2	61.9	66.1	71.0	76.5	83.0	4.40	4.68	5.00	5.37	5.78	6.27	70.4	74.9	80.0	85.9	92.5	100.3
		$\frac{1}{2}$	58.3	62.0	66.2	71.0	76.5	82.9	3.93	4.18	4.47	4.79	5.16	5.60	62.9	66.9	71.5	76.6	82.5	89.6
		$\frac{7}{16}$	58.3	62.0	66.2	71.0	76.5	82.9	3.46	3.68	3.93	4.21	4.54	4.92	55.3	58.9	62.9	67.3	72.6	78.7
6	8	1	65.4	68.5	72.0	75.8	80.0	85.0	8.50	8.90	9.36	9.85	10.40	11.05	136.0	142.4	149.7	157.6	166.4	176.8
		$\frac{15}{16}$	65.4	68.5	72.0	75.8	80.0	85.0	8.01	8.39	8.82	9.28	9.80	10.41	128.1	134.2	141.1	148.5	156.8	166.5
		$\frac{7}{8}$	65.5	68.5	72.0	75.8	80.0	84.9	7.52	7.86	8.27	8.70	9.18	9.75	120.3	125.7	132.3	139.2	146.9	156.0
		$\frac{13}{16}$	65.5	68.6	72.0	75.8	80.0	84.8	7.02	7.35	7.72	8.13	8.58	9.09	112.3	117.6	123.5	130.0	137.3	145.4
		$\frac{3}{4}$	65.5	68.6	72.0	75.8	80.0	84.7	6.51	6.82	7.16	7.53	7.95	8.42	104.1	109.1	114.5	120.5	127.2	134.7
		$\frac{11}{16}$	65.6	68.6	72.1	75.8	80.0	84.7	6.00	6.28	6.60	6.94	7.32	7.75	96.0	100.5	105.6	111.0	117.1	124.0
		$\frac{5}{8}$	65.6	68.7	72.1	75.9	80.0	84.6	5.48	5.74	6.03	6.34	6.69	7.07	87.7	91.8	96.5	101.4	107.0	113.1
		$\frac{9}{16}$	65.6	68.7	72.1	75.9	80.0	84.6	4.96	5.19	5.45	5.74	6.05	6.40	79.3	83.0	87.2	91.8	96.8	102.4
		$\frac{1}{2}$	65.7	68.8	72.2	75.9	80.0	84.5	4.43	4.64	4.87	5.12	5.40	5.70	70.9	74.2	77.9	81.9	86.4	91.2
		$\frac{7}{16}$	65.7	68.8	72.2	75.9	80.0	84.5	3.90	4.08	4.28	4.50	4.74	5.01	62.4	65.3	68.5	72.0	75.8	80.1

TABLE IV—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

Two Holes for $\frac{3}{4}$-inch Rivets Deducted from Connected Leg



Diameter of each hole = $\frac{7}{8}$ inch.

Allowable stress = 16,000 lb. per sq.in.

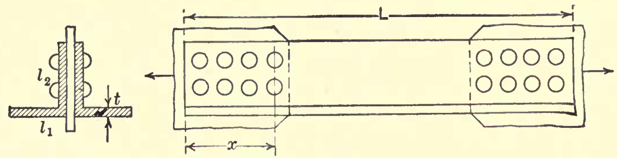
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. for One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
6	6	$\frac{7}{8}$	59.3	62.6	66.4	70.7	75.6	81.1	5.77	6.09	6.46	6.88	7.36	7.89	92.3	97.4	103.3	110.1	117.7	126.2
		$\frac{13}{16}$	59.4	62.7	66.4	70.7	75.6	81.1	5.40	5.70	6.04	6.43	6.87	7.37	86.4	91.2	96.6	102.9	109.9	117.9
		$\frac{3}{4}$	59.5	62.8	66.5	70.7	75.6	81.0	5.02	5.30	5.61	5.97	6.38	6.84	80.3	84.8	89.7	95.5	102.1	109.4
		$\frac{11}{16}$	59.5	62.8	66.5	70.7	75.6	81.0	4.63	4.89	5.17	5.50	5.88	6.30	74.1	78.2	82.7	88.0	94.1	100.8
		$\frac{5}{8}$	59.6	62.9	66.6	70.8	75.5	80.9	4.24	4.47	4.73	5.03	5.37	5.75	67.8	71.5	75.7	80.5	85.9	92.0
		$\frac{9}{16}$	59.6	62.9	66.6	70.8	75.5	80.9	3.83	4.04	4.28	4.55	4.85	5.20	61.3	64.6	68.5	72.8	77.6	83.2
		$\frac{1}{2}$	59.7	63.0	66.7	70.8	75.5	80.8	3.43	3.62	3.83	4.07	4.34	4.65	54.9	57.9	61.3	65.1	69.4	74.4
		$\frac{7}{16}$	59.8	63.1	66.8	70.9	75.5	80.8	3.03	3.19	3.38	3.59	3.82	4.09	48.5	51.0	54.1	57.4	61.1	65.4
		$\frac{3}{8}$	59.9	63.2	66.9	70.9	75.5	80.7	2.61	2.76	2.92	3.09	3.29	3.52	41.7	44.1	46.7	49.4	52.6	56.3

4	6	$\frac{7}{8}$	59.3	62.6	66.4	70.7	75.6	81.2	4.73	5.00	5.30	5.64	6.03	6.48	75.7	80.0	84.8	90.2	96.5	103.7
		$\frac{13}{16}$	59.4	62.7	66.4	70.7	75.6	81.1	4.44	4.68	4.96	5.28	5.65	6.06	71.0	74.9	79.3	84.5	90.4	96.9
		$\frac{3}{4}$	59.5	62.8	66.5	70.8	75.6	81.1	4.13	4.36	4.61	4.91	5.25	5.63	66.1	69.7	73.7	78.5	84.0	90.1
		$\frac{11}{16}$	59.6	62.9	66.5	70.8	75.6	81.0	3.81	4.02	4.26	4.53	4.84	5.18	60.9	64.3	68.1	72.5	77.4	82.9
		$\frac{5}{8}$	59.6	63.0	66.6	70.8	75.6	81.0	3.49	3.69	3.90	4.15	4.43	4.75	55.8	59.0	62.4	66.4	70.9	76.0
		$\frac{9}{16}$	59.7	63.1	66.6	70.8	75.6	80.9	3.17	3.35	3.54	3.76	4.01	4.30	50.7	53.6	56.6	60.1	64.1	68.8
		$\frac{1}{2}$	59.8	63.1	66.7	70.8	75.6	80.9	2.84	3.00	3.17	3.36	3.59	3.84	45.4	48.0	50.7	53.7	57.4	61.4
		$\frac{7}{16}$	59.9	63.2	66.7	70.9	75.6	80.8	2.50	2.64	2.79	2.96	3.16	3.38	40.0	42.2	44.6	47.3	50.5	54.1
		$\frac{3}{8}$	60.0	63.2	66.8	70.9	75.6	80.8	2.17	2.28	2.41	2.56	2.73	2.92	34.7	36.5	38.5	40.9	43.7	46.7
$3\frac{1}{2}$	5	$\frac{5}{8}$	57.6	60.3	63.1	66.4	70.0	74.0	2.83	2.97	3.10	3.27	3.44	3.64	45.3	47.5	49.6	52.3	55.0	58.2
		$\frac{9}{16}$	57.7	60.4	63.2	66.4	70.0	74.0	2.58	2.70	2.82	2.97	3.13	3.31	41.3	43.2	45.1	47.5	50.1	52.9
		$\frac{1}{2}$	57.8	60.5	63.3	66.5	70.1	74.0	2.31	2.42	2.53	2.66	2.80	2.96	36.9	38.7	40.5	42.5	44.8	47.3
		$\frac{7}{16}$	57.9	60.6	63.4	66.6	70.1	74.0	2.04	2.14	2.24	2.35	2.47	2.61	32.6	34.2	35.8	37.6	39.5	41.7
		$\frac{3}{8}$	58.0	60.7	63.5	66.7	70.1	74.0	1.77	1.85	1.94	2.03	2.14	2.26	28.3	29.6	31.0	32.5	34.2	36.1
		$\frac{5}{16}$	58.1	60.8	63.6	66.8	70.2	74.0	1.49	1.56	1.63	1.71	1.80	1.89	23.8	24.9	26.1	28.3	28.8	30.2
3	5	$\frac{1}{2}$	58.3	60.7	63.4	66.3	69.4	72.8	2.19	2.28	2.38	2.49	2.60	2.73	35.0	36.5	38.1	39.8	41.6	43.7
		$\frac{7}{16}$	58.5	60.9	63.5	66.4	69.5	73.9	1.94	2.02	2.10	2.20	2.30	2.45	31.0	32.3	33.6	35.2	36.8	39.2
		$\frac{3}{8}$	58.6	61.0	63.6	66.5	69.6	73.0	1.68	1.74	1.82	1.90	1.99	2.09	26.9	27.8	29.1	30.4	31.8	33.4
		$\frac{5}{16}$	58.8	61.2	63.7	66.6	69.7	73.0	1.41	1.47	1.53	1.60	1.67	1.75	22.6	23.5	24.5	25.6	26.7	28.0

TABLE IV—*Concluded*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

Two Holes for $\frac{5}{8}$-inch Rivets Deducted from Connected Leg



Diameter of each hole $= \frac{3}{4}$ inch.

Allowable stress = 16,000 lb. per sq.in.

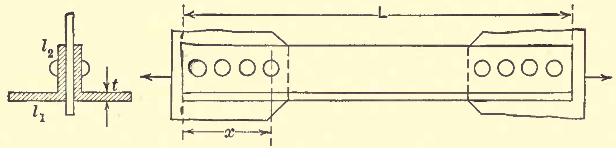
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. for One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
8	8	$\frac{5}{8}$	65.3	68.8	72.8	77.3	82.4	88.2	6.27	6.61	7.00	7.43	7.92	8.48	100.3	105.7	112.0	118.9	126.7	135.7
		$\frac{9}{16}$	65.3	68.8	72.9	77.4	82.3	88.1	5.67	5.97	6.33	6.72	7.14	7.65	90.7	95.5	101.3	107.5	114.2	122.4
		$\frac{1}{2}$	65.4	68 9	72.9	77.4	82.3	88.1	5.07	5.34	5.65	6.00	6.38	6.83	81.1	85.4	90.4	96.0	102.1	109.3
8	6	$\frac{5}{8}$	60.0	63.8	68.2	73.2	78.9	85.7	5.02	5.33	5.70	6.12	6.60	7.16	80.3	85.3	91.2	97.9	105.6	114.5
		$\frac{9}{16}$	60.1	63.9	68.2	73.2	78.9	85.6	4.54	4.83	5.16	5.53	5.96	6.47	72.6	77.3	82.5	88.5	95.4	103.5
		$\frac{1}{2}$	60.1	64.0	68.3	73.2	78.8	85.5	4.06	4.32	4.61	4.94	5.32	5.77	64.9	69.1	73.7	79.0	85.1	92.3
		$\frac{7}{16}$	60.2	64.0	68.3	73.2	78.8	85.5	3.57	3.79	4.05	4.34	4.67	5.07	57.1	60.6	64.8	69.4	74.7	81.1

6	8	5/8	67.5	70.7	74.2	78.1	82.3	87.0	5.64	5.91	6.20	6.53	6.88	7.27	90.2	94.6	99.2	104.5	110.1	116.3
		9/16	67.6	70.7	74.2	78.0	82.2	86.9	5.11	5.34	5.61	5.90	6.21	6.57	81.8	85.4	89.8	94.4	99.3	105.1
		1/2	67.6	70.7	74.2	78.0	82.2	86.9	4.56	4.77	5.01	5.26	5.55	5.86	72.9	76.3	80.2	84.1	88.8	93.7
		7/16	67.7	70.7	74.2	78.0	82.1	86.8	4.01	4.19	4.40	4.63	4.87	5.15	64.1	67.0	70.4	74.1	77.9	82.4
6	6	5/8	61.8	65.2	69.1	73.4	78.4	84.0	4.39	4.64	4.91	5.22	5.57	5.97	70.2	74.2	78.5	83.5	89.1	95.5
		9/16	61.9	65.3	69.1	73.5	78.4	83.9	3.98	4.20	4.44	4.73	5.04	5.39	63.7	67.2	71.0	75.7	80.6	86.2
		1/2	62.0	65.4	69.2	73.5	78.3	83.9	3.56	3.76	3.98	4.23	4.50	4.82	56.9	60.1	63.7	67.7	72.0	77.1
		7/16	62.1	65.4	69.2	73.5	78.3	83.8	3.14	3.31	3.50	3.72	3.96	4.24	50.2	52.9	56.0	59.5	63.3	67.8
		3/8	62.2	65.5	69.3	73.5	78.3	83.8	2.71	2.86	3.02	3.20	3.41	3.65	43.3	45.7	48.3	51.2	54.5	58.4
4	6	5/8	64.3	67.1	70.3	73.8	77.5	81.7	3.77	3.93	4.12	4.32	4.54	4.79	60.3	62.9	65.9	69.1	72.6	76.6
		9/16	64.4	67.2	70.4	73.8	77.5	81.7	3.42	3.57	3.74	3.92	4.11	4.34	54.7	57.1	59.8	62.7	65.7	69.4
		1/2	64.5	67.3	70.5	73.8	77.5	81.6	3.06	3.20	3.35	3.50	3.68	3.87	48.9	51.2	53.6	56.0	58.9	61.9
		7/16	64.6	67.3	70.5	73.8	77.5	81.6	2.70	2.81	2.95	3.08	3.24	3.41	43.2	44.9	47.2	49.3	51.8	54.5
		3/8	64.7	67.4	70.5	73.8	77.5	81.6	2.33	2.43	2.54	2.66	2.80	2.94	37.3	38.9	40.6	42.5	44.8	47.0
3½	5	5/8	60.7	63.5	66.6	70.0	73.8	78.0	2.99	3.12	3.28	3.44	3.63	3.84	47.8	49.9	52.5	55.0	58.1	61.4
		9/16	60.8	63.6	66.6	70.1	73.8	78.0	2.72	2.84	2.98	3.13	3.30	3.49	43.5	45.4	47.7	50.1	52.8	55.8
		1/2	60.9	63.7	66.7	70.1	73.8	78.0	2.44	2.55	2.67	2.80	2.95	3.12	39.0	40.8	42.7	44.8	47.2	49.9
		7/16	61.0	63.8	66.8	70.2	73.9	78.0	2.15	2.25	2.36	2.48	2.61	2.75	34.4	36.0	37.7	39.7	41.7	44.0
		3/8	61.1	63.9	66.9	70.2	73.9	78.0	1.86	1.95	2.04	2.14	2.25	2.38	29.7	31.2	32.6	34.2	36.0	38.1
		5/16	61.2	64.0	67.0	70.3	73.9	78.0	1.57	1.64	1.71	1.80	1.89	2.00	25.1	26.2	27.3	28.8	30.2	32.0
	5	1/2	61.7	64.2	67.0	70.0	73.5	77.0	2.31	2.41	2.51	2.62	2.75	2.89	36.9	38.5	40.1	41.9	44.0	46.2
		7/16	61.8	64.3	67.1	70.1	73.5	77.0	2.04	2.13	2.22	2.32	2.43	2.55	32.6	34.1	35.5	37.1	38.9	40.8
		3/8	61.9	64.4	67.2	70.2	73.5	77.0	1.77	1.84	1.92	2.01	2.10	2.20	28.3	29.4	30.7	32.1	33.6	35.2
		5/16	62.0	64.5	67.3	70.3	73.5	77.0	1.49	1.55	1.61	1.69	1.76	1.85	23.8	24.8	25.7	27.0	28.1	29.6

TABLE V

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

One Hole for $\frac{7}{8}$-inch Rivet Deducted from Connected Leg



Diameter of each hole = 1 inch.

Allowable stress = 16,000 lb. per sq.in.

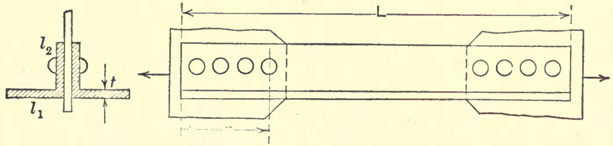
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
8	6	1	63.5	67.6	72.3	77.8	84.2	91.7	8.25	8.79	9.40	10.11	10.95	11.92	132.0	140.6	150.4	161.7	175.2	190.7
		$\frac{15}{16}$	63.5	67.6	72.3	77.8	84.1	91.6	7.78	8.28	8.86	9.53	10.30	11.22	124.5	132.5	141.7	152.5	164.8	179.5
		$\frac{7}{8}$	63.6	67.7	72.3	77.8	84.1	91.5	7.30	7.77	8.30	8.93	9.65	10.50	116.8	124.3	132.8	142.9	154.4	168.0
		$\frac{13}{16}$	63.6	67.7	72.4	77.8	84.0	91.4	6.82	7.26	7.76	8.34	9.00	9.80	109.1	116.1	124.1	133.4	144.0	156.8
		$\frac{3}{4}$	63.7	67.8	72.4	77.8	84.0	91.3	6.33	6.74	7.20	7.73	8.35	9.07	101.3	107.8	115.2	123.7	133.6	145.1
		$\frac{11}{16}$	63.7	67.8	72.4	77.8	83.9	91.1	5.83	6.20	6.62	7.12	7.68	8.33	93.3	99.2	105.9	113.9	122.9	133.3
		$\frac{5}{8}$	63.8	67.8	72.4	77.8	83.8	91.0	5.33	5.67	6.05	6.50	7.01	7.61	85.3	90.7	96.8	104.0	112.1	121.7
		$\frac{9}{16}$	63.8	67.9	72.5	77.7	83.7	90.8	4.82	5.13	5.48	5.87	6.33	6.86	77.1	82.1	87.7	93.9	101.3	116.2
		$\frac{1}{2}$	63.9	67.9	72.5	77.7	83.7	90.7	4.31	4.58	4.89	5.24	5.65	6.12	68.9	73.3	78.2	83.8	90.4	97.9
		$\frac{7}{16}$	63.9	67.9	72.5	77.7	83.6	90.6	3.79	4.03	4.30	4.61	4.96	5.37	60.6	64.5	68.8	73.7	79.3	85.9

6	6	1	66.0	69.7	74.0	78.8	84.3	90.6	7.26	7.67	8.14	8.67	9.27	9.96	116.1	122.7	130.2	138.7	148.3	159.3
		$\frac{15}{16}$	66.0	69.7	74.0	78.8	84.2	90.5	6.84	7.23	7.67	8.17	8.73	9.38	109.4	115.7	122.7	130.7	139.6	150.1
		$\frac{7}{8}$	66.1	69.7	74.0	78.7	84.1	90.3	6.43	6.78	7.20	7.66	8.18	8.78	102.9	108.5	115.2	122.5	130.9	140.5
		$\frac{13}{16}$	66.1	69.8	74.0	78.7	84.1	90.2	6.01	6.34	6.73	7.15	7.64	8.20	96.1	101.4	107.7	114.4	122.2	131.2
		$\frac{3}{4}$	66.1	69.8	74.0	78.7	84.0	90.1	5.58	5.89	6.25	6.64	7.09	7.60	89.3	94.2	100.0	106.2	113.4	121.6
		$\frac{11}{16}$	66.2	69.8	74.0	78.6	84.0	90.0	5.15	5.43	5.76	6.11	6.53	7.00	82.4	86.9	92.1	97.7	104.5	112.0
		$\frac{5}{8}$	66.2	69.9	74.0	78.6	83.9	89.8	4.71	4.97	5.26	5.59	5.96	6.38	75.3	79.5	84.1	89.4	95.3	102.1
		$\frac{9}{16}$	66.2	69.9	74.0	77.6	83.8	89.7	4.26	4.49	4.76	5.05	5.39	5.77	68.1	71.8	76.1	80.8	86.2	92.3
		$\frac{1}{2}$	66.3	69.9	74.0	78.5	83.7	89.6	3.81	4.02	4.25	4.51	4.81	5.15	60.9	64.3	68.0	72.1	76.9	82.4
		$\frac{7}{16}$	66.3	70.0	74.0	78.5	83.7	89.5	3.35	3.54	3.74	3.97	4.23	4.53	53.6	56.6	59.8	63.5	67.7	72.5
		$\frac{3}{8}$	66.4	70.0	74.0	78.5	83.6	89.5	2.89	3.05	3.33	3.42	3.64	3.90	46.2	48.8	53.3	54.7	58.2	62.4
6	4	$\frac{7}{8}$	58.5	62.6	67.4	72.9	79.5	87.2	4.67	4.99	5.38	5.82	6.34	6.96	74.7	79.8	86.1	93.1	101.4	111.3
		$\frac{13}{16}$	58.7	62.7	67.5	72.9	79.4	87.1	4.38	4.68	5.04	5.45	5.93	6.51	70.1	74.9	80.6	87.2	94.9	104.1
		$\frac{3}{4}$	58.8	62.8	67.5	73.0	79.4	87.0	4.08	4.36	4.68	5.07	5.51	6.04	65.3	69.7	74.9	81.1	88.1	96.6
		$\frac{11}{16}$	58.9	62.9	67.6	73.0	79.3	86.9	3.77	4.02	4.33	4.67	5.07	5.56	60.3	64.3	69.3	74.7	81.1	88.9
		$\frac{5}{8}$	59.0	63.0	67.7	73.0	79.3	86.7	3.46	3.69	3.97	4.28	4.65	5.08	55.3	59.0	63.5	68.5	74.4	81.3
		$\frac{9}{16}$	59.1	63.1	67.7	73.0	79.2	86.6	3.14	3.35	3.59	3.88	4.20	4.60	50.2	53.6	57.4	62.1	67.2	73.6
		$\frac{1}{2}$	59.2	63.2	67.8	73.0	79.2	86.5	2.81	3.00	3.22	3.47	3.76	4.11	44.9	48.0	51.5	55.5	60.1	65.7
		$\frac{7}{16}$	59.3	63.3	67.8	73.1	79.1	86.4	2.48	2.64	2.83	3.05	3.31	3.61	39.7	42.2	45.3	48.8	52.9	57.7
		$\frac{3}{8}$	59.4	63.4	67.9	73.1	79.1	86.3	2.14	2.29	2.45	2.64	2.85	3.11	34.2	36.6	39.2	42.2	45.6	49.7
4	6	$\frac{7}{8}$	69.6	72.7	76.2	80.0	84.3	89.0	5.55	5.80	6.08	6.38	6.73	7.10	88.8	92.8	97.3	102.1	107.7	113.6
		$\frac{13}{16}$	69.6	72.7	76.2	80.0	84.2	88.9	5.20	5.43	5.69	5.98	6.29	6.64	83.2	86.9	91.0	95.7	100.6	106.2
		$\frac{3}{4}$	69.6	72.7	76.2	80.0	84.1	88.8	4.83	5.04	5.29	5.55	5.84	6.16	77.3	80.6	84.6	88.8	93.4	98.5
		$\frac{11}{16}$	69.6	72.7	76.2	79.9	84.0	88.6	4.45	4.65	4.88	5.11	5.37	5.67	71.2	74.4	78.1	81.7	85.9	90.7
		$\frac{5}{8}$	69.7	72.7	76.2	79.9	84.0	88.5	4.08	4.26	4.46	4.68	4.92	5.18	65.3	68.1	71.3	74.9	78.7	82.9

TABLE V—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

One Hole for $\frac{7}{8}$-inch Rivet Deducted from Connected Leg



Diameter of each hole = 1 inch.

Allowable stress = 16,000 lb. per sq.in.

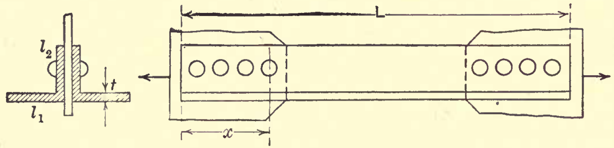
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
4	6	$\frac{9}{16}$	69.7	72.8	76.2	79.9	83.9	88.4	3.70	3.86	4.05	4.24	4.45	4.69	59.2	61.7	64.8	67.8	71.2	75.0
		$\frac{1}{2}$	69.7	72.8	76.2	79.8	83.9	88.3	3.31	3.46	3.62	3.79	3.98	4.19	52.9	55.3	57.9	60.6	63.7	67.0
		$\frac{7}{16}$	69.8	72.8	76.1	79.8	83.8	88.2	2.92	3.04	3.18	3.33	3.50	3.69	46.7	48.6	50.9	53.3	56.0	59.0
		$\frac{3}{8}$	69.8	72.8	76.1	79.8	83.7	88.1	2.52	2.63	2.75	2.88	3.02	3.18	40.3	42.1	44.0	46.1	48.3	50.9
5	$3\frac{1}{2}$	$\frac{5}{8}$	57.5	61.5	65.9	71.1	77.1	84.3	2.83	3.02	3.24	3.50	3.79	4.15	45.3	48.3	51.8	56.0	60.6	66.4
		$\frac{9}{16}$	57.6	61.6	66.0	71.1	77.1	84.2	2.57	2.75	2.95	3.18	3.45	3.76	41.1	44.0	47.2	50.9	55.2	60.1
		$\frac{1}{2}$	57.8	61.7	66.1	71.2	77.1	84.1	2.31	2.47	2.64	2.85	3.08	3.36	36.9	39.5	42.2	45.6	49.3	53.7
		$\frac{7}{16}$	58.0	61.8	66.2	71.2	77.1	84.0	2.05	2.18	2.34	2.51	2.72	2.96	32.8	34.9	37.4	40.1	43.5	47.3
		$\frac{3}{8}$	58.1	61.9	66.3	71.2	77.1	83.9	1.77	1.89	2.02	2.17	2.35	2.56	28.3	30.2	32.3	34.7	37.6	40.9
		$\frac{5}{16}$	58.2	62.0	66.3	71.3	77.1	83.8	1.49	1.59	1.70	1.83	1.97	2.15	23.8	25.4	27.2	29.3	31.5	34.4

3½	5	$\frac{5}{8}$	67.0	70.1	73.6	77.3	81.5	86.2	3.30	3.45	3.62	3.80	4.01	4.24	52.8	55.2	57.9	60.8	64.1	67.8
		$\frac{9}{16}$	67.1	70.2	73.6	77.3	81.5	86.1	3.00	3.14	3.29	3.45	3.64	3.85	48.0	50.2	52.6	55.2	58.2	61.6
		$\frac{1}{2}$	67.2	70.2	73.6	77.3	81.4	86.0	2.69	2.81	2.94	3.09	3.25	3.44	43.0	44.9	47.0	49.4	52.0	55.0
		$\frac{7}{16}$	67.2	70.3	73.6	77.3	81.4	85.9	2.37	2.48	2.60	2.73	2.87	3.03	37.9	39.7	41.6	43.7	45.9	48.5
		$\frac{3}{8}$	67.3	70.3	73.6	77.3	81.3	85.8	2.05	2.14	2.24	2.36	2.48	2.62	32.8	34.2	35.8	37.7	39.7	41.9
		$\frac{5}{16}$	67.3	70.4	73.6	77.3	81.3	85.7	1.72	1.80	1.89	1.98	2.08	2.20	27.5	28.8	30.2	31.7	33.3	35.2
5	3	$\frac{5}{8}$	54.6	58.6	63.3	68.6	75.0	82.7	2.52	2.70	2.92	3.16	3.46	3.81	40.3	43.2	46.7	50.5	55.3	60.9
		$\frac{9}{16}$	54.8	58.7	63.4	68.6	75.0	82.6	2.29	2.45	2.65	2.87	3.13	3.45	36.6	39.2	42.4	45.9	50.1	55.2
		$\frac{1}{2}$	55.0	58.9	63.5	68.7	75.0	82.5	2.06	2.21	2.38	2.58	2.81	3.09	32.9	35.3	38.1	41.3	44.9	49.4
		$\frac{7}{16}$	55.2	59.0	63.6	68.8	75.0	82.4	1.83	1.95	2.10	2.28	2.48	2.73	29.3	31.2	33.6	36.5	39.7	43.7
		$\frac{3}{8}$	55.3	59.2	63.7	68.9	75.0	82.3	1.58	1.69	1.82	1.97	2.14	2.35	25.3	27.0	29.1	31.5	34.2	37.6
		$\frac{5}{16}$	55.5	59.3	63.8	69.0	75.0	82.2	1.33	1.42	1.53	1.66	1.80	1.97	21.3	22.7	24.5	26.5	28.8	31.5
3	5	$\frac{5}{8}$	68.2	71.1	74.2	77.7	81.4	85.6	3.14	3.28	3.42	3.58	3.75	3.95	50.2	52.5	54.7	57.3	60.0	63.2
		$\frac{9}{16}$	68.2	71.1	74.2	77.7	81.4	85.5	2.85	2.97	3.10	3.25	3.40	3.57	45.6	47.5	49.6	52.0	54.4	57.1
		$\frac{1}{2}$	68.3	71.2	74.2	77.6	81.3	85.4	2.56	2.67	2.78	2.91	3.05	3.20	40.9	42.7	44.5	46.5	48.8	51.2
		$\frac{7}{16}$	68.3	71.2	74.3	77.6	81.3	85.3	2.26	2.36	2.46	2.57	2.69	2.82	36.1	37.7	39.3	41.1	43.0	45.1
		$\frac{3}{8}$	68.4	71.3	74.3	77.6	81.2	85.2	1.96	2.04	2.12	2.22	2.32	2.44	31.3	32.6	33.9	35.5	37.1	39.0
		$\frac{5}{16}$	68.5	71.3	74.3	77.6	81.2	85.1	1.64	1.71	1.78	1.86	1.95	2.04	26.2	27.3	28.5	29.7	31.2	32.6
4	4	$\frac{5}{8}$	61.5	64.9	68.9	73.4	78.5	84.2	2.83	2.99	3.18	3.38	3.62	3.88	45.3	47.8	50.9	54.1	57.9	62.1
		$\frac{9}{16}$	61.6	65.0	68.9	73.4	78.4	84.1	2.57	2.72	2.88	3.07	3.28	3.51	41.1	43.5	46.1	49.1	52.5	56.1
		$\frac{1}{2}$	61.7	65.1	69.0	73.4	78.4	84.0	2.31	2.44	2.59	2.75	2.94	3.15	36.9	39.0	41.4	44.0	47.0	50.4
		$\frac{7}{16}$	61.8	65.2	69.0	73.4	78.3	84.0	2.04	2.16	2.28	2.43	2.59	2.78	32.6	34.5	36.5	38.9	41.4	44.5
		$\frac{3}{8}$	61.9	65.3	69.1	73.5	78.3	83.9	1.77	1.87	1.98	2.10	2.24	2.40	28.3	29.9	31.7	33.6	35.8	38.4
		$\frac{5}{16}$	62.0	65.4	69.1	73.5	78.2	83.8	1.49	1.57	1.66	1.76	1.88	2.01	23.8	25.1	26.5	28.1	30.1	32.1
		$\frac{1}{4}$	62.1	65.5	69.2	73.5	78.2	83.7	1.20	1.27	1.34	1.43	1.52	1.62	19.2	20.3	21.4	22.9	24.3	25.9

TABLE V—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

One Hole for $\frac{7}{8}$-inch Rivet Deducted from Connected Leg



Diameter of each hole = 1 inch.

Allowable stress = 16,000 lb. per sq.in.

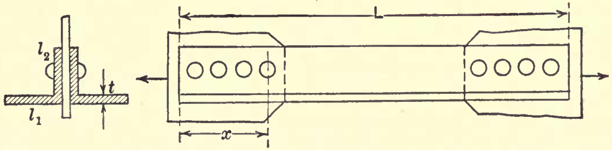
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
4	3	$\frac{1}{2}$	55.7	59.4	63.6	68.4	74.0	80.5	1.81	1.93	2.07	2.22	2.40	2.62	28.9	30.9	33.1	35.5	38.4	41.9
		$\frac{7}{16}$	55.9	59.5	63.7	68.5	74.0	80.4	1.60	1.71	1.83	1.97	2.12	2.31	25.6	27.3	29.3	31.5	33.9	36.9
		$\frac{3}{8}$	56.1	59.7	63.8	68.5	74.0	80.4	1.39	1.48	1.58	1.70	1.83	1.99	22.2	23.7	25.3	27.2	29.3	31.8
		$\frac{5}{16}$	56.3	59.9	64.0	68.6	74.0	80.3	1.18	1.25	1.34	1.43	1.55	1.68	18.9	20.0	21.4	22.9	24.8	26.9
		$\frac{1}{4}$	56.5	60.0	64.1	68.7	74.1	80.3	0.95	1.01	1.08	1.16	1.25	1.36	15.2	16.1	17.3	18.5	20.0	21.7
3	4	$\frac{1}{2}$	63.5	66.5	69.9	73.7	77.8	82.5	2.06	2.16	2.27	2.39	2.53	2.68	32.9	34.5	36.3	38.2	40.5	42.9
		$\frac{7}{16}$	63.6	66.6	69.9	73.7	77.7	82.4	1.82	1.91	2.01	2.11	2.23	2.36	29.1	30.5	32.1	33.7	35.7	37.7
		$\frac{3}{8}$	63.7	66.7	70.0	73.7	77.7	82.3	1.58	1.65	1.74	1.83	1.93	2.04	25.3	26.4	27.8	29.3	30.9	32.6
		$\frac{5}{16}$	63.8	66.7	70.0	73.7	77.6	82.2	1.33	1.39	1.46	1.54	1.62	1.72	21.3	22.2	23.3	24.6	25.9	27.5
		$\frac{1}{4}$	63.9	66.8	70.1	73.7	77.6	82.1	1.08	1.13	1.18	1.24	1.31	1.39	17.3	18.1	18.9	19.8	20.9	22.2

$3\frac{1}{2}$	$3\frac{1}{2}$	$\frac{5}{8}$	59.3	62.8	66.6	71.0	76.0	81.8	2.36	2.50	2.65	2.83	3.02	3.25	37.7	40.0	42.7	45.3	48.3	52.0
		$\frac{9}{16}$	59.5	62.9	66.7	71.0	76.0	81.7	2.15	2.28	2.41	2.57	2.75	2.96	34.4	36.5	38.5	41.1	44.0	47.3
		$\frac{1}{2}$	59.6	63.0	66.8	71.1	76.0	81.6	1.94	2.05	2.17	2.31	2.47	2.65	31.0	32.8	34.7	36.9	39.5	42.4
		$\frac{7}{16}$	59.8	63.1	66.9	71.1	76.0	81.5	1.72	1.81	1.92	2.04	2.18	2.34	27.5	28.9	30.7	32.6	34.9	37.4
		$\frac{3}{8}$	59.9	63.2	67.0	71.2	76.0	81.4	1.47	1.57	1.66	1.76	1.88	2.02	23.5	25.1	26.5	28.1	30.1	32.3
		$\frac{5}{16}$	60.0	63.3	67.1	71.2	76.0	81.4	1.25	1.32	1.40	1.49	1.59	1.70	20.0	21.1	22.4	23.8	25.4	27.2
		$\frac{1}{4}$	60.2	63.5	67.2	71.3	76.0	81.3	1.02	1.07	1.13	1.20	1.28	1.37	16.3	17.1	18.1	19.2	20.5	21.9
$3\frac{1}{2}$	3	$\frac{1}{2}$	56.2	59.7	63.6	68.1	73.3	79.3	1.69	1.79	1.91	2.04	2.20	2.38	27.0	28.6	30.5	32.6	35.2	38.1
		$\frac{7}{16}$	56.4	59.8	63.8	68.3	73.3	79.3	1.49	1.58	1.69	1.81	1.94	2.10	23.8	25.3	27.0	28.9	31.0	33.6
		$\frac{3}{8}$	56.6	60.0	63.9	68.3	73.4	79.3	1.30	1.38	1.47	1.57	1.69	1.82	20.8	22.1	23.5	25.1	27.0	29.1
		$\frac{5}{16}$	56.8	60.2	64.0	68.4	73.4	79.3	1.10	1.16	1.23	1.32	1.42	1.53	17.6	18.5	19.7	21.1	22.7	24.5
		$\frac{1}{4}$	57.0	60.4	64.2	68.5	73.5	79.3	0.89	0.94	1.00	1.07	1.15	1.24	14.2	15.0	16.0	17.1	18.4	19.8
3	$3\frac{1}{2}$	$\frac{1}{2}$	60.4	63.6	67.1	71.0	75.5	80.5	1.81	1.91	2.01	2.13	2.26	2.41	28.9	30.5	32.1	34.1	36.1	38.5
		$\frac{7}{16}$	60.5	63.7	67.2	71.1	75.5	80.4	1.60	1.69	1.78	1.88	2.00	2.13	25.6	27.0	28.5	30.1	32.0	34.1
		$\frac{3}{8}$	60.7	63.8	67.3	71.1	75.5	80.4	1.40	1.47	1.55	1.63	1.74	1.85	22.4	23.5	24.8	26.1	27.8	29.6
		$\frac{5}{16}$	60.8	63.9	67.4	71.2	75.5	80.3	1.17	1.23	1.30	1.37	1.46	1.55	18.7	19.7	20.8	21.9	23.3	24.8
		$\frac{1}{4}$	61.0	64.0	67.5	71.3	75.5	80.2	0.95	1.00	1.05	1.11	1.18	1.25	15.2	16.0	16.8	17.7	18.9	20.0
3	3	$\frac{1}{2}$	56.8	60.1	63.7	67.9	72.6	78.0	1.56	1.65	1.75	1.87	2.00	2.14	24.9	26.4	28.0	29.9	32.0	34.2
		$\frac{7}{16}$	57.0	60.2	63.9	68.0	72.6	78.0	1.38	1.46	1.55	1.65	1.76	1.89	22.1	23.3	24.8	26.4	28.1	30.2
		$\frac{3}{8}$	57.2	60.4	64.0	68.1	72.7	78.0	1.21	1.27	1.35	1.44	1.53	1.64	19.3	20.3	21.6	23.0	24.5	26.2
		$\frac{5}{16}$	57.4	60.5	64.2	68.2	72.7	78.0	1.02	1.08	1.14	1.21	1.29	1.39	16.3	17.3	18.2	19.3	20.6	22.2
		$\frac{1}{4}$	57.6	60.7	64.3	68.3	72.8	78.0	0.83	0.87	0.93	0.98	1.05	1.12	13.3	13.9	14.9	15.7	16.8	17.9
$2\frac{1}{2}$	3	$\frac{3}{8}$	57.9	60.8	64.2	67.8	72.0	76.6	1.00	1.05	1.11	1.17	1.24	1.32	16.0	16.8	17.7	18.7	19.8	21.1
		$\frac{5}{16}$	58.1	60.0	64.3	67.9	72.0	76.6	0.85	0.88	0.94	1.00	1.06	1.13	13.6	14.1	15.0	16.0	16.9	18.1
		$\frac{1}{4}$	58.3	61.3	64.5	68.1	72.1	76.6	0.69	0.73	0.77	0.81	0.86	0.91	11.0	11.7	12.3	12.9	13.7	14.5

TABLE V—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

One Hole for $\frac{3}{4}$-inch Rivet Deducted from Connected Leg



Diameter of each hole = $\frac{7}{8}$ inch.

Allowable stress = 16,000 lb. per Sq.in.

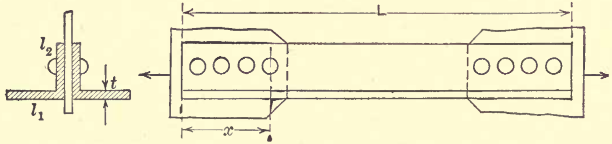
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
6	6	$\frac{7}{8}$	67.1	71.0	75.2	80.1	85.7	92.0	6.53	6.91	7.32	7.79	8.34	8.95	104.5	110.5	117.1	124.6	133.4	143.2
		$\frac{13}{16}$	67.1	71.0	75.2	80.1	85.6	91.9	6.10	6.45	6.83	7.28	7.78	8.35	97.6	103.2	109.3	116.5	124.5	133.6
		$\frac{3}{4}$	67.2	71.0	75.2	80.1	85.6	91.8	5.67	5.99	6.35	6.76	7.22	7.75	90.7	95.8	101.6	108.1	115.5	124.0
		$\frac{11}{16}$	67.2	71.0	75.2	80.0	85.5	91.6	5.23	5.52	5.85	6.22	6.65	7.13	83.7	88.3	93.6	99.5	106.4	114.1
		$\frac{5}{8}$	67.3	71.0	75.2	80.0	85.4	91.5	4.78	5.05	5.35	5.69	6.07	6.50	76.5	80.8	85.6	91.0	97.1	104.0
		$\frac{9}{16}$	67.3	71.1	75.2	80.0	85.3	91.3	4.33	4.57	4.83	5.14	5.48	5.87	69.3	73.1	77.3	82.2	87.7	93.9
		$\frac{1}{2}$	67.4	71.1	75.2	79.9	85.2	91.2	3.87	4.09	4.32	4.59	4.90	5.24	61.9	65.4	69.1	73.4	78.4	83.8
		$\frac{7}{16}$	67.4	71.1	75.2	79.9	85.1	91.1	3.41	3.60	3.80	4.04	4.31	4.61	54.5	57.6	60.8	64.6	68.9	73.7
		$\frac{3}{8}$	67.5	71.1	75.2	79.9	85.0	91.0	2.94	3.10	3.28	3.48	3.71	3.97	47.0	49.6	52.5	55.7	59.4	63.5
6	4	$\frac{7}{8}$	59.9	64.1	69.0	74.7	81.3	89.2	4.78	5.11	5.51	5.96	6.49	7.12	76.5	81.7	88.1	95.3	103.8	114.9
		$\frac{13}{16}$	60.0	64.2	69.0	74.7	81.2	89.1	4.48	4.80	5.15	5.58	6.06	6.66	71.7	76.8	82.4	89.3	96.9	106.5
		$\frac{3}{4}$	60.1	64.3	69.1	74.7	81.2	89.0	4.17	4.46	4.80	5.18	5.63	6.18	66.7	71.3	76.8	82.9	90.1	98.9

		11/16	60.2	64.3	69.1	74.7	81.1	88.9	3.85	4.11	4.42	4.78	5.19	5.69	61.6	65.7	70.7	76.5	83.0	91.0
		5/8	60.3	64.4	69.1	74.7	81.1	88.7	3.53	3.77	4.05	4.38	4.75	5.20	56.5	60.3	64.8	70.1	76.0	83.2
		9/16	60.4	64.5	69.2	74.7	81.0	88.5	3.21	3.42	3.67	3.97	4.30	4.70	51.3	54.7	58.7	63.5	68.8	75.2
		1/2	60.5	64.5	69.2	74.7	81.0	88.4	2.87	3.06	3.29	3.55	3.85	4.20	45.9	48.9	52.6	56.8	61.6	67.2
		7/16	60.6	64.6	69.2	74.7	80.9	88.3	2.53	2.70	2.89	3.12	3.38	3.69	40.5	43.2	46.2	49.9	54.1	59.0
		3/8	60.7	64.7	69.3	74.7	80.9	88.2	2.19	2.33	2.50	2.70	2.92	3.18	35.0	37.3	40.0	43.2	46.7	50.9
4	6	7/8	70.9	74.1	77.7	81.6	86.0	90.7	5.66	5.91	6.20	6.51	6.86	7.24	90.5	94.5	99.2	104.1	109.7	115.8
		13/16	70.9	74.1	77.7	81.5	85.9	90.6	5.30	5.53	5.80	6.09	6.42	6.77	84.8	88.5	92.8	97.4	102.7	108.3
		3/4	71.0	74.1	77.7	81.5	85.8	90.5	4.93	5.14	5.39	5.66	5.95	6.28	78.9	82.2	86.2	90.5	95.2	100.5
		11/16	71.0	74.1	77.6	81.4	85.7	90.4	4.54	4.74	4.97	5.21	5.48	5.78	72.6	75.8	79.5	83.3	87.7	92.5
		5/8	71.0	74.1	77.6	81.4	85.6	90.2	4.16	4.34	4.55	4.77	5.02	5.29	66.5	69.4	72.8	76.3	80.3	84.6
		9/16	71.0	74.1	77.6	81.3	85.5	90.1	3.77	3.91	4.12	4.32	4.54	4.78	60.3	62.5	65.9	69.1	72.6	76.5
		1/2	71.0	74.1	77.5	81.3	85.4	90.0	3.37	3.52	3.68	3.86	4.06	4.27	53.9	56.3	58.9	61.7	64.9	68.3
		7/16	71.1	74.1	77.5	81.2	85.3	89.9	2.97	3.10	3.24	3.39	3.56	3.76	47.5	49.6	51.8	54.2	56.9	60.1
		3/8	71.1	74.1	77.5	81.2	85.3	89.7	2.57	2.67	2.80	2.93	3.08	3.24	41.1	42.7	44.8	46.9	49.3	51.8
5	3½	5/8	59.2	63.1	67.7	73.0	79.2	86.6	2.91	3.10	3.33	3.59	3.90	4.26	46.5	49.6	53.3	57.4	62.4	68.1
		9/16	59.3	63.2	67.8	73.0	79.1	86.5	2.65	2.82	3.03	3.26	3.53	3.87	42.4	45.1	48.5	52.1	56.5	61.9
		1/2	59.4	63.3	67.9	73.0	79.1	86.4	2.38	2.53	2.72	2.92	3.16	3.45	38.1	40.5	43.5	46.7	50.5	55.2
		7/16	59.5	63.4	67.9	73.0	79.1	86.3	2.10	2.24	2.40	2.58	2.79	3.05	33.6	35.8	38.4	41.3	44.6	48.8
		3/8	59.6	63.5	68.0	73.0	79.0	86.1	1.82	1.94	2.07	2.23	2.41	2.62	29.1	31.0	33.1	35.7	38.5	41.9
		5/16	59.7	63.6	68.0	73.0	79.0	86.0	1.53	1.63	1.74	1.87	2.02	2.20	24.5	26.1	27.8	29.9	32.3	35.2
3½	5	5/8	68.6	71.8	75.3	79.2	83.5	88.3	3.37	3.53	3.70	3.90	4.11	4.34	53.9	56.5	59.2	62.4	65.7	69.4
		9/16	68.6	71.8	75.3	79.2	83.4	88.1	3.07	3.21	3.36	3.54	3.73	3.94	49.1	51.3	53.7	56.6	59.7	63.0
		1/2	68.7	71.9	75.3	79.1	83.3	88.0	2.75	2.88	3.01	3.16	3.33	3.52	44.0	46.1	48.1	50.5	53.3	56.3
		7/16	68.7	71.9	75.3	79.1	83.2	87.9	2.42	2.54	2.66	2.79	2.94	3.10	38.7	40.6	42.5	44.6	47.0	49.6
		3/8	68.8	71.9	75.3	79.1	83.1	87.8	2.10	2.19	2.30	2.41	2.53	2.68	33.6	35.0	36.8	38.5	40.5	42.9
		5/16	68.9	72.0	75.3	79.0	83.1	87.6	1.76	1.84	1.93	2.02	2.12	2.24	28.1	29.4	30.9	32.3	33.9	35.8

TABLE V—*Continued*

EFFICIENCY AND ALLOWABLE TENSION FOR ANGLES RIVETED THROUGH ONE LEG TO A RIGID CONNECTION PLATE

One Hole for $\frac{3}{4}$-inch Rivet Deducted from Connected Leg



Diameter of each hole = $\frac{7}{8}$ inch.

Allowable stress = 16,000 per sq.in.

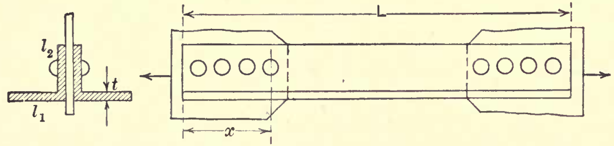
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
5	3	$\frac{5}{8}$	56.3	60.5	65.2	70.7	77.3	85.3	2.59	2.79	3.00	3.26	3.56	3.93	41.4	44.6	48.0	52.1	56.9	62.9
		$\frac{9}{16}$	56.4	60.6	65.3	70.8	77.3	85.1	2.36	2.53	2.73	2.96	3.23	3.56	37.7	40.5	43.7	47.3	51.7	56.9
		$\frac{1}{2}$	56.6	60.7	65.4	70.8	77.2	85.0	2.12	2.28	2.45	2.65	2.89	3.19	33.9	36.5	39.2	42.4	46.2	51.0
		$\frac{7}{16}$	56.8	60.9	65.5	70.8	77.2	84.9	1.88	2.01	2.17	2.34	2.55	2.81	30.1	32.1	34.7	37.4	40.8	44.9
		$\frac{3}{8}$	57.0	61.0	65.6	70.9	77.2	84.8	1.63	1.74	1.88	2.03	2.21	2.42	26.1	27.8	30.1	32.5	35.3	38.7
		$\frac{5}{16}$	57.2	61.1	65.7	70.9	77.2	84.7	1.37	1.47	1.58	1.70	1.85	2.03	21.9	23.5	25.3	27.2	29.6	32.5
3	5	$\frac{5}{8}$	69.9	72.8	76.0	79.6	83.5	87.8	3.22	3.36	3.50	3.67	3.85	4.05	51.5	53.7	56.0	58.7	61.6	64.8
		$\frac{9}{16}$	69.9	72.9	76.0	79.6	83.4	87.6	2.99	3.05	3.18	3.33	3.49	3.66	47.8	48.8	50.9	53.3	55.8	58.5
		$\frac{1}{2}$	70.0	72.9	76.0	79.5	83.3	87.5	2.62	2.73	2.85	2.98	3.12	3.28	41.9	43.7	45.6	47.7	49.9	52.5
		$\frac{7}{16}$	70.0	72.9	76.0	79.5	83.2	87.4	2.32	2.41	2.51	2.63	2.75	2.89	37.1	38.5	40.1	42.1	44.0	46.2
		$\frac{3}{8}$	70.1	73.0	76.0	79.5	83.1	87.3	2.00	2.09	2.17	2.27	2.38	2.50	32.0	33.4	34.7	36.3	38.1	40.0
		$\frac{5}{16}$	70.1	73.0	76.0	79.4	83.0	87.1	1.68	1.75	1.82	1.90	1.99	2.09	26.9	28.0	29.1	30.4	31.8	33.4

4	4	5/8	63.1	66.7	70.8	75.4	80.6	86.6	2.91	3.07	3.26	3.47	3.71	3.99	46.5	49.1	52.1	55.5	59.3	63.8
		9/16	63.2	66.8	70.8	75.4	80.5	86.4	2.64	2.79	2.96	3.15	3.36	3.61	42.2	44.6	47.3	50.4	53.7	57.7
		1/2	63.3	66.9	70.9	75.4	80.5	86.3	2.37	2.51	2.66	2.83	3.02	3.24	37.9	40.1	42.5	45.3	48.3	51.8
		7/16	63.4	67.0	70.9	75.4	80.4	86.2	2.10	2.22	2.35	2.49	2.66	2.85	33.6	35.5	37.6	39.8	42.5	45.6
		3/8	63.5	67.1	71.0	75.4	80.4	86.1	1.82	1.92	2.03	2.16	2.30	2.46	29.1	30.7	32.5	34.5	36.8	39.3
		5/16	63.6	67.2	71.0	75.4	80.3	86.0	1.53	1.61	1.70	1.81	1.93	2.06	24.5	25.7	27.2	28.9	30.9	32.9
		1/4	63.7	67.3	71.1	75.4	80.3	85.9	1.23	1.30	1.38	1.46	1.56	1.66	19.7	20.8	22.1	23.3	24.9	26.5
4	3	1/2	57.7	61.5	65.8	70.7	76.5	83.3	1.87	2.00	2.14	2.30	2.49	2.71	29.9	32.0	34.2	36.8	39.8	43.3
		7/16	57.8	61.6	65.9	70.8	76.5	83.2	1.66	1.77	1.89	2.03	2.19	2.39	26.5	28.3	30.2	32.5	35.0	38.2
		3/8	58.0	61.8	66.0	70.9	76.5	83.1	1.44	1.53	1.64	1.76	1.90	2.06	23.0	24.5	26.2	28.1	30.4	32.9
		5/16	58.1	61.9	66.1	71.0	76.5	83.0	1.21	1.29	1.38	1.48	1.60	1.73	19.3	20.6	22.1	23.7	25.6	27.7
		1/4	58.3	62.0	66.2	71.0	76.5	83.0	0.99	1.05	1.12	1.20	1.29	1.40	15.8	16.8	17.9	19.2	20.6	22.4
3	4	1/2	65.4	68.5	72.0	75.8	80.1	85.0	2.12	2.23	2.34	2.46	2.60	2.76	33.9	35.7	37.4	39.3	41.6	44.1
		7/16	65.5	68.5	72.0	75.8	80.1	84.9	1.88	1.97	2.07	2.17	2.30	2.44	30.1	31.5	33.1	34.7	36.8	39.0
		3/8	65.6	68.7	72.1	75.9	80.0	84.8	1.63	1.70	1.79	1.88	1.98	2.10	26.1	27.2	28.6	30.1	31.7	33.6
		5/16	65.7	68.7	72.1	75.9	80.0	84.7	1.37	1.43	1.51	1.59	1.67	1.77	21.9	22.9	24.1	25.4	26.7	28.3
		1/4	65.8	68.8	72.2	75.9	80.0	84.5	1.11	1.16	1.22	1.28	1.35	1.43	17.7	18.5	19.5	20.5	21.6	22.9
3½	3½	5/8	61.2	64.8	68.9	73.4	78.5	84.4	2.43	2.58	2.74	2.92	3.12	3.36	38.9	41.3	43.8	46.7	49.9	53.7
		9/16	61.4	64.9	69.0	73.4	78.5	84.3	2.22	2.35	2.50	2.66	2.84	3.05	35.5	37.6	40.0	42.5	45.4	48.8
		1/2	61.5	65.0	69.0	73.4	78.4	84.2	2.00	2.11	2.24	2.38	2.55	2.74	32.0	33.7	35.8	38.1	40.8	43.8
		7/16	61.6	65.1	69.1	73.4	78.4	84.1	1.77	1.87	1.98	2.11	2.25	2.41	28.3	29.9	31.7	33.7	36.0	38.5
		3/8	61.7	65.2	69.1	73.5	78.4	84.0	1.53	1.62	1.71	1.82	1.94	2.08	24.5	25.9	27.3	29.1	31.0	33.3
		5/16	61.9	65.3	69.2	73.5	78.3	83.9	1.29	1.36	1.45	1.54	1.64	1.75	20.6	21.7	23.2	24.6	26.2	28.0
		1/4	62.0	65.4	69.2	73.5	78.3	83.8	1.05	1.10	1.17	1.24	1.32	1.42	16.8	17.6	18.7	19.8	21.1	22.7
3½	3	1/2	58.3	62.0	66.0	70.7	76.1	82.3	1.75	1.86	1.98	2.12	2.28	2.47	28.0	29.7	31.7	33.9	36.5	39.5
		7/16	58.5	62.1	66.1	70.7	76.1	82.2	1.55	1.64	1.75	1.87	2.02	2.18	24.8	26.2	28.0	29.9	32.3	34.9
		3/8	58.7	62.2	66.3	70.8	76.1	82.1	1.35	1.43	1.52	1.63	1.75	1.89	21.6	22.9	24.3	26.1	28.0	30.2
		5/16	58.9	62.4	66.4	70.8	76.1	82.0	1.14	1.20	1.28	1.37	1.47	1.58	18.2	19.2	20.5	21.9	23.5	25.3
		1/4	59.0	62.5	66.5	70.9	76.1	82.0	0.92	0.97	1.04	1.11	1.19	1.28	14.7	15.5	16.6	17.7	19.0	20.5

TABLE V—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

One Hole for $\frac{3}{4}$-inch Rivet Deducted from Connected Leg



Diameter of each hole = $\frac{7}{8}$ inch.

Allowable stress = 16,000 lb. per Sq.in.

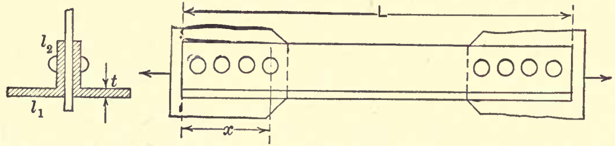
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
3	$3\frac{1}{2}$	$\frac{1}{2}$	62.5	65.8	69.5	73.5	78.0	83.3	1.87	1.97	2.08	2.20	2.34	2.50	29.9	31.5	33.3	35.2	37.4	40.0
		$\frac{7}{16}$	62.5	65.9	69.5	73.5	78.0	83.2	1.66	1.75	1.84	1.95	2.07	2.20	26.5	28.0	29.4	31.2	33.1	35.2
		$\frac{3}{8}$	62.7	66.0	69.6	73.6	78.0	83.1	1.44	1.52	1.60	1.69	1.79	1.91	23.0	24.3	25.6	27.0	28.6	30.5
		$\frac{5}{16}$	62.8	66.1	69.6	73.6	78.0	83.0	1.21	1.27	1.34	1.42	1.50	1.60	19.3	20.3	21.4	22.7	24.0	25.6
		$\frac{1}{4}$	63.0	66.2	69.7	73.7	78.0	82.9	0.98	1.03	1.09	1.15	1.22	1.29	15.7	16.5	17.4	18.4	19.5	20.6
$3\frac{1}{2}$	$2\frac{1}{2}$	$\frac{1}{2}$	54.5	58.2	62.5	67.4	73.2	80.0	1.50	1.60	1.72	1.85	2.01	2.20	24.0	25.6	27.5	29.6	32.1	35.2
		$\frac{7}{16}$	54.7	58.4	62.6	67.5	73.2	79.9	1.33	1.42	1.52	1.64	1.78	1.94	21.3	22.7	24.3	26.2	28.5	31.0
		$\frac{3}{8}$	55.0	58.6	62.8	67.6	73.2	79.8	1.16	1.24	1.32	1.43	1.54	1.68	18.5	19.8	21.1	22.9	24.6	26.9
		$\frac{5}{16}$	55.2	58.8	62.9	67.7	73.2	79.7	0.98	1.05	1.12	1.20	1.30	1.42	15.7	16.8	17.9	19.2	20.8	22.7
		$\frac{1}{4}$	55.4	59.0	63.1	67.8	73.2	79.7	0.80	0.85	0.91	0.98	1.05	1.15	12.8	13.6	14.5	15.7	16.8	18.4

2½	3½	½	63.7	66.7	70.0	73.7	77.8	82.3	1.75	1.83	1.92	2.03	2.14	2.26	28.0	29.3	30.7	32.5	34.2	36.1
		7/16	63.8	66.8	70.0	73.7	77.8	82.2	1.55	1.62	1.70	1.79	1.89	2.00	24.8	25.9	27.2	28.6	30.2	32.0
		3/8	63.9	66.9	70.1	73.7	77.7	82.1	1.35	1.41	1.48	1.55	1.64	1.73	21.6	22.5	23.7	24.8	26.2	27.7
		5/16	64.0	67.0	70.1	73.8	77.7	82.1	1.14	1.19	1.25	1.31	1.38	1.46	18.2	19.0	20.0	20.9	22.1	23.3
		¼	64.1	67.1	70.2	73.8	77.7	82.0	0.92	0.97	1.01	1.06	1.12	1.18	14.7	15.5	16.1	16.9	17.9	18.9
3	3	½	59.1	62.5	66.3	70.7	75.6	81.2	1.62	1.72	1.82	1.94	2.08	2.23	25.9	27.5	29.1	31.0	33.3	35.7
		7/16	59.3	62.6	66.4	70.7	75.6	81.1	1.44	1.52	1.61	1.72	1.84	1.97	23.0	24.3	25.7	27.5	29.4	31.5
		3/8	59.4	62.7	66.5	70.7	75.5	81.0	1.25	1.32	1.40	1.49	1.59	1.71	20.0	21.1	22.4	23.8	25.4	27.3
		5/16	59.6	62.8	66.6	70.8	75.5	80.9	1.06	1.12	1.18	1.26	1.34	1.44	16.9	17.9	18.9	20.1	21.4	23.0
		¼	59.8	63.0	66.7	70.8	75.5	80.8	0.86	0.91	0.96	1.02	1.09	1.16	13.7	14.5	15.3	16.3	17.4	18.5
3	2½	3/8	55.5	58.9	62.8	67.2	72.4	78.4	1.06	1.13	1.20	1.29	1.39	1.50	16.0	18.1	19.2	20.6	22.2	24.0
		5/16	55.7	59.1	63.0	67.3	72.4	78.3	0.90	0.96	1.02	1.09	1.17	1.27	14.4	15.3	16.3	17.4	18.7	20.3
		¼	55.9	59.3	63.1	67.5	72.5	78.2	0.73	0.78	0.83	0.88	0.95	1.02	11.7	12.5	13.3	14.1	15.2	16.3
2½	3	3/8	60.4	63.5	66.9	70.7	75.0	79.9	1.16	1.22	1.28	1.36	1.44	1.53	18.5	19.5	20.5	21.7	23.0	24.5
		5/16	60.5	63.6	67.0	70.7	75.0	79.8	0.98	1.03	1.08	1.14	1.21	1.29	15.7	16.5	17.3	18.2	19.3	20.6
		¼	60.7	63.7	67.1	70.8	75.0	79.7	0.79	0.83	0.88	0.93	0.98	1.04	12.6	13.3	14.1	14.9	15.7	16.6
2½	2½	3/8	56.1	59.3	62.8	67.0	71.5	76.8	0.97	1.03	1.09	1.16	1.24	1.33	15.5	16.5	17.4	18.5	19.8	21.3
		5/16	56.3	59.5	63.0	67.1	71.6	76.8	0.83	0.88	0.93	0.99	1.05	1.13	13.3	14.1	14.9	15.8	16.8	18.1
		¼	56.5	59.7	63.2	67.2	71.6	76.8	0.67	0.71	0.75	0.80	0.85	0.91	10.7	11.3	12.0	12.8	13.6	14.5
		3/16	56.7	59.9	63.4	67.3	71.7	76.8	0.51	0.54	0.57	0.60	0.64	0.69	8.1	8.6	9.1	9.6	10.2	11.0
2	2½	3/8	56.8	59.7	62.9	66.4	70.5	75.0	0.88	0.93	0.97	1.03	1.09	1.16	14.1	14.9	15.5	16.5	17.4	18.5
		5/16	57.1	60.0	63.1	66.6	70.5	75.0	0.75	0.79	0.83	0.87	0.92	0.98	12.0	12.6	13.3	13.9	14.7	15.7
		¼	57.4	60.2	63.3	66.8	70.5	75.0	0.61	0.64	0.67	0.71	0.75	0.79	9.8	10.2	10.7	11.3	12.0	12.6
		3/16	57.7	60.4	63.5	67.0	70.5	75.0	0.47	0.49	0.51	0.54	0.57	0.61	7.5	7.8	8.2	8.6	9.1	9.8

TABLE V—*Continued*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

One Hole for $\frac{5}{8}$-inch Rivet Deducted from Connected Leg



Diameter of each hole $= \frac{3}{4}$ inch.

Allowable stress = 16,000 lb. per sq.in.

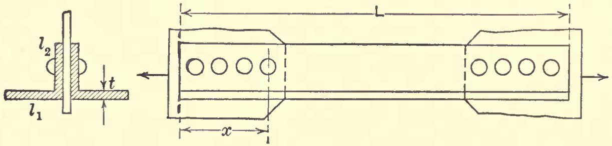
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
6	6	$\frac{5}{8}$	68.4	72.1	76.5	81.2	86.7	92.9	4.86	5.13	5.44	5.77	6.16	6.60	77.7	82.1	87.0	92.3	98.5	105.6
		$\frac{9}{16}$	68.4	72.1	76.5	81.2	86.6	92.7	4.40	4.64	4.92	5.22	5.57	5.96	70.4	74.2	78.7	83.5	89.1	95.3
		$\frac{1}{2}$	68.5	72.2	76.5	81.1	86.5	92.5	3.94	4.15	4.40	4.66	4.97	5.32	63.0	66.4	70.4	74.5	79.5	85.1
		$\frac{7}{16}$	68.5	72.2	76.5	81.1	86.4	92.4	3.47	3.65	3.87	4.10	4.37	4.67	55.5	58.4	61.9	65.6	69.9	74.7
		$\frac{3}{8}$	68.6	72.2	76.5	81.1	86.3	92.3	2.99	3.15	3.33	3.54	3.76	4.02	47.8	50.4	53.3	56.6	60.1	64.3
6	4	$\frac{5}{8}$	61.6	65.9	70.7	76.3	82.9	90.6	3.61	3.86	4.14	4.47	4.86	5.31	57.7	61.7	66.2	71.5	77.7	84.9
		$\frac{9}{16}$	61.7	65.9	70.7	76.3	82.8	90.4	3.28	3.50	3.75	4.05	4.40	4.80	52.5	56.0	60.0	64.8	70.4	76.8
		$\frac{1}{2}$	61.8	66.0	70.7	76.3	82.7	90.3	2.93	3.13	3.36	3.62	3.93	4.29	46.9	50.1	53.7	57.9	62.9	68.6
		$\frac{7}{16}$	61.9	66.0	70.8	76.3	82.7	90.1	2.59	2.76	2.96	3.19	3.46	3.77	41.4	44.1	47.3	51.0	55.3	60.3
		$\frac{3}{8}$	62.0	66.1	70.8	76.3	82.6	90.0	2.24	2.39	2.56	2.75	2.98	3.25	35.8	38.2	40.9	44.0	47.7	52.0
4	6	$\frac{5}{8}$	72.3	75.6	79.1	82.9	87.2	92.0	4.24	4.43	4.63	4.86	5.11	5.39	67.8	70.9	74.1	77.7	81.7	86.2
		$\frac{9}{16}$	72.3	75.6	79.1	82.9	87.1	91.8	3.84	4.01	4.20	4.40	4.62	4.87	61.4	64.1	67.2	70.4	73.9	77.9

		$\frac{1}{2}$	72.4	75.6	79.0	82.8	87.0	91.7	3.44	3.59	3.75	3.93	4.13	4.35	55.0	57.4	60.0	62.9	66.1	69.6
		$\frac{7}{16}$	72.4	75.6	79.0	82.8	86.9	91.5	3.04	3.16	3.30	3.46	3.63	3.82	48.6	50.5	52.8	55.3	58.1	61.1
		$\frac{3}{8}$	72.5	75.6	79.0	82.7	86.8	91.4	2.62	2.73	2.85	2.98	3.13	3.30	41.9	43.7	45.6	47.7	50.1	52.8
5	$3\frac{1}{2}$	$\frac{5}{8}$	60.7	64.9	69.6	75.0	81.4	88.9	2.99	3.19	3.42	3.69	4.00	4.37	47.8	51.0	54.7	59.0	64.0	69.9
		$\frac{9}{16}$	60.8	65.0	69.6	75.0	81.3	88.7	2.72	2.90	3.11	3.35	3.63	3.96	43.5	46.4	49.7	53.6	58.1	63.3
		$\frac{1}{2}$	60.9	65.0	69.6	75.0	81.2	88.6	2.44	2.60	2.78	3.00	3.25	3.54	39.0	41.6	44.5	48.0	52.0	56.6
		$\frac{7}{16}$	61.0	65.1	69.7	75.0	81.2	88.5	2.15	2.30	2.46	2.65	2.87	3.12	34.4	36.8	39.3	42.4	45.9	49.9
		$\frac{3}{8}$	61.1	65.2	69.7	75.0	81.1	88.3	1.86	1.99	2.12	2.29	2.47	2.69	29.7	31.8	33.9	36.6	39.5	43.0
		$\frac{5}{16}$	61.2	65.3	69.8	75.0	81.1	88.2	1.57	1.67	1.79	1.92	2.08	2.26	25.1	26.7	28.6	30.7	33.3	36.1
$3\frac{1}{2}$	5	$\frac{5}{8}$	70.2	73.5	77.0	81.0	85.4	90.3	3.45	3.62	3.79	3.98	4.20	4.44	55.2	57.9	60.6	63.7	67.2	71.0
		$\frac{9}{16}$	70.2	73.5	77.0	81.0	85.3	90.1	3.14	3.28	3.44	3.62	3.81	4.03	50.2	52.5	55.0	57.9	60.9	64.5
		$\frac{1}{2}$	70.3	73.5	77.0	80.9	85.2	90.0	2.81	2.94	3.08	3.24	3.41	3.60	44.9	47.0	49.3	51.8	54.5	57.6
		$\frac{7}{16}$	70.3	73.6	77.0	80.9	85.1	89.8	2.48	2.60	2.72	2.85	3.00	3.17	39.7	41.6	43.5	45.6	48.0	50.7
		$\frac{3}{8}$	70.4	73.6	77.0	80.8	85.0	89.7	2.15	2.24	2.35	2.46	2.59	2.73	34.4	35.8	37.6	39.3	41.4	43.7
		$\frac{5}{16}$	70.4	73.6	77.0	80.8	84.9	89.5	1.80	1.88	1.97	2.07	2.17	2.29	28.8	30.1	31.5	33.1	34.7	36.6
5	3	$\frac{5}{8}$	58.0	62.3	67.2	72.9	79.7	87.8	2.67	2.87	3.10	3.36	3.67	4.05	42.7	45.9	49.6	53.7	58.7	64.8
		$\frac{9}{16}$	58.1	62.4	67.3	72.9	79.6	87.6	2.43	2.61	2.81	3.05	3.33	3.66	38.9	41.7	44.9	48.8	53.3	58.5
		$\frac{1}{2}$	58.3	62.5	67.3	73.0	79.6	87.5	2.19	2.34	2.52	2.74	2.98	3.28	35.0	37.4	40.3	43.8	47.7	52.5
		$\frac{7}{16}$	58.4	62.6	67.4	73.0	79.5	87.4	1.93	2.07	2.23	2.42	2.63	2.89	30.9	33.1	35.7	38.7	42.1	46.2
		$\frac{3}{8}$	58.6	62.7	67.4	73.0	79.5	87.2	1.67	1.79	1.93	2.09	2.27	2.49	26.7	28.6	30.9	33.4	36.3	39.8
		$\frac{5}{16}$	58.7	62.8	67.5	73.0	79.4	87.1	1.41	1.51	1.62	1.75	1.90	2.09	22.5	24.1	25.9	28.0	30.4	33.4
3	5	$\frac{5}{8}$	71.6	74.6	77.9	81.6	85.5	89.9	3.30	3.44	3.59	3.76	3.94	4.14	52.8	55.0	57.4	60.1	63.0	66.2
		$\frac{9}{16}$	71.6	74.6	77.9	81.5	85.4	89.7	2.99	3.12	3.26	3.41	3.57	3.75	47.8	49.9	52.1	54.5	57.1	60.0
		$\frac{1}{2}$	71.7	74.7	77.9	81.5	85.3	89.6	2.69	2.80	2.92	3.06	3.20	3.36	43.0	44.8	46.7	48.9	51.2	53.7
		$\frac{7}{16}$	71.7	74.7	77.9	81.4	85.2	89.4	2.37	2.47	2.58	2.69	2.82	2.96	37.9	39.5	41.3	43.0	45.1	47.3
		$\frac{3}{8}$	71.7	74.7	77.9	81.4	85.2	89.3	2.05	2.14	2.23	2.33	2.44	2.55	32.8	34.2	35.7	37.3	39.0	40.8
		$\frac{5}{16}$	71.8	74.7	77.9	81.3	85.1	89.1	1.72	1.79	1.87	1.95	2.04	2.14	27.5	28.6	29.7	31.2	32.6	34.2

TABLE V—*Continued*

EFFICIENCY AND ALLOWABLE TENSION FOR ANGLES RIVETED THROUGH ONE LEG TO A RIGID CONNECTION PLATE

One Hole for $\frac{5}{8}$-inch Rivet Deducted from Connected Leg



Diameter of each hole $= \frac{3}{4}$ inch.

Allowable stress $= 16{,}000$ lb. per sq.in.

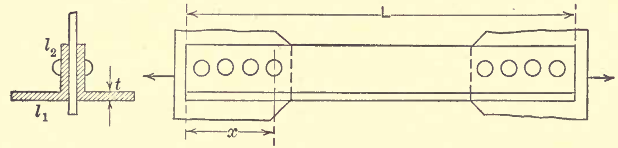
Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
4	4	$\frac{5}{8}$	64.8	68.5	72.7	77.4	82.8	88.9	2.99	3.16	3.35	3.57	3.82	4.10	47.8	50.5	53.6	57.1	61.1	65.6
		$\frac{9}{16}$	64.9	68.5	72.7	77.4	82.7	88.7	2.71	2.86	3.04	3.23	3.46	3.71	43.3	45.7	48.6	51.7	55.3	59.3
		$\frac{1}{2}$	65.0	68.6	72.7	77.3	82.6	88.5	2.44	2.57	2.73	2.90	3.10	3.32	39.0	41.1	43.7	46.4	49.6	53.1
		$\frac{7}{16}$	65.0	68.6	72.7	77.3	82.5	88.4	2.15	2.27	2.41	2.56	2.73	2.93	34.4	36.3	38.5	40.9	43.7	46.9
		$\frac{3}{8}$	65.1	68.7	72.8	77.3	82.4	88.2	1.86	1.96	2.08	2.21	2.36	2.52	29.7	31.3	33.3	35.3	37.7	40.3
		$\frac{5}{16}$	65.2	68.7	72.8	77.3	82.4	88.1	1.56	1.65	1.75	1.85	1.98	2.11	24.9	26.4	28.0	29.6	31.7	33.7
		$\frac{1}{4}$	65.3	68.8	72.8	77.3	82.3	88.0	1.27	1.33	1.41	1.50	1.60	1.71	20.3	21.3	22.5	24.0	25.6	27.3
4	3	$\frac{1}{2}$	59.6	63.5	68.0	73.0	79.0	86.1	1.94	2.06	2.21	2.37	2.57	2.80	31.0	32.9	35.3	37.9	41.1	44.8
		$\frac{7}{16}$	59.7	63.6	68.0	73.0	79.0	85.9	1.71	1.82	1.95	2.09	2.26	2.46	27.3	29.1	31.2	33.4	36.1	39.3
		$\frac{3}{8}$	59.9	63.7	68.1	73.1	79.0	85.8	1.48	1.58	1.69	1.81	1.96	2.13	23.7	25.3	27.0	28.9	31.3	34.1
		$\frac{5}{16}$	60.0	63.8	68.1	73.1	78.9	85.6	1.25	1.33	1.42	1.53	1.65	1.79	20.0	21.3	22.7	24.5	26.4	28.6
		$\frac{1}{4}$	60.2	63.9	68.2	73.2	78.9	85.5	1.02	1.08	1.15	1.24	1.33	1.44	16.3	17.3	18.4	19.8	21.3	23.0

3	4	$\frac{1}{2}$	67.3	70.5	74.2	78.2	82.5	87.5	2.19	2.29	2.41	2.54	2.68	2.84	35.0	36.6	38.5	40.6	42.9	45.4
		$\frac{7}{16}$	67.4	70.6	74.2	78.1	82.4	87.3	1.93	2.03	2.13	2.24	2.36	2.50	30.9	32.5	34.1	35.8	37.7	40.0
		$\frac{3}{8}$	67.5	70.6	74.2	78.1	82.3	87.2	1.67	1.75	1.84	1.94	2.04	2.16	26.7	28.0	29.4	31.0	32.6	34.5
		$\frac{5}{16}$	67.5	70.7	74.2	78.0	82.3	87.0	1.41	1.48	1.55	1.63	1.72	1.82	22.5	23.7	24.8	26.1	27.5	29.1
		$\frac{1}{4}$	67.6	70.7	74.2	78.0	82.2	86.9	1.14	1.19	1.25	1.32	1.39	1.47	18.2	19.0	20.0	21.1	22.2	23.5
$3\frac{1}{2}$	$3\frac{1}{2}$	$\frac{5}{8}$	63.2	66.8	71.0	75.7	81.1	87.2	2.51	2.66	2.82	3.01	3.23	3.47	40.1	42.5	45.1	48.1	51.7	55.5
		$\frac{9}{16}$	63.3	66.9	71.1	75.7	81.0	87.0	2.29	2.42	2.57	2.74	2.93	3.15	36.6	38.7	41.1	43.8	46.9	50.4
		$\frac{1}{2}$	63.4	67.0	71.1	75.7	80.9	86.9	2.06	2.18	2.31	2.46	2.63	2.82	32.9	34.9	36.9	39.3	42.1	45.1
		$\frac{7}{16}$	63.5	67.0	71.2	75.7	80.8	86.7	1.82	1.92	2.04	2.17	2.32	2.49	29.1	30.7	32.6	34 7	37.1	39.8
		$\frac{3}{8}$	63.6	67.1	71.2	75.7	80.7	86.5	1.58	1.66	1.76	1.88	2.00	2.14	25.3	26.5	28.1	30.1	32.0	34.2
		$\frac{5}{16}$	63.7	67.2	71.3	75.7	80.6	86.3	1.33	1.40	1.49	1.58	1.68	1.80	21.3	22.4	23.8	25.3	26.9	28.8
		$\frac{1}{4}$	63.8	67.3	71.3	75.7	80.6	86.2	1.08	1.14	1.20	1.28	1.36	1.46	17.3	18.2	19.2	20.5	21.7	23.3
$3\frac{1}{2}$	3	$\frac{1}{2}$	60.4	64.1	68.3	73.2	78.8	85.2	1.81	1.92	2.05	2.20	2.36	2.56	28.9	30.7	32.8	35.2	37.7	40.9
		$\frac{7}{16}$	60.5	64.2	68.4	73.2	78.7	85.1	1.60	1.70	1.81	1.94	2.08	2.25	25.6	27.2	28.9	31.0	33.3	36.0
		$\frac{3}{8}$	60.7	64.4	68.5	73.2	78.7	85.0	1.40	1.48	1.57	1.68	1.81	1.95	22.4	23.7	25.1	26.9	28.9	31.2
		$\frac{5}{16}$	60.8	64.5	68.6	73.3	78.6	84.9	1.17	1.24	1.32	1.41	1.52	1.64	18.7	19.8	21.1	22.5	24.3	26.2
		$\frac{1}{4}$	61.0	64.6	68.7	73.3	78.6	84.8	0.95	1.01	1.07	1.14	1.23	1.32	15.2	16.1	17.1	18.2	19.7	21.1
3	$3\frac{1}{2}$	$\frac{1}{2}$	64.5	67.9	71.7	75.9	80.6	86.0	1.93	2.04	2.15	2.28	2.42	2.58	30.9	32.6	34.4	36.5	38.7	41.3
		$\frac{7}{16}$	64.6	68.0	71.7	75.9	80.6	85.9	1.71	1.80	1.90	2.01	2.13	2.28	27.3	28.8	30.4	32.1	34.1	36.5
		$\frac{3}{8}$	64.8	68.1	71.8	76.0	80.6	85.8	1.49	1.57	1.65	1.75	1.85	1.97	23.8	25.1	26.4	28.0	29.6	31.5
		$\frac{5}{16}$	64.9	68.1	71.8	76.0	80.5	85.6	1.25	1.31	1.38	1.47	1.55	1.65	20.0	20.9	22.1	23.5	24.8	26.4
		$\frac{1}{4}$	65.0	68.2	71.9	76.0	80.5	85.5	1.01	1.06	1.12	1.18	1.25	1.33	16.1	16.9	17.9	18.9	20.0	21.3
$3\frac{1}{2}$	$2\frac{1}{2}$	$\frac{1}{2}$	56.8	60.7	65.1	70.2	76.2	83.3	1.56	1.67	1.79	1.93	2.09	2.29	24.9	26.7	28.6	30.9	33.4	36.6
		$\frac{7}{16}$	57.0	60.8	65.2	70.3	76.2	83.1	1.38	1.48	1.58	1.71	1.85	2.02	22.1	23.7	25.3	27.3	29.6	32.3

TABLE V—*Concluded*

Efficiency and Allowable Tension for Angles Riveted through One Leg to a Rigid Connection Plate

One Hole for $\frac{5}{8}$-inch Rivet Deducted from Connected Leg



Diameter of each hole $= \frac{3}{4}$ inch.

Allowable stress = 16,000 lb. per sq.in.

Size of Angle.			Efficiency in Per Cent for Values of $\frac{x}{L}$.						Equivalent Area in Sq.in. of One Angle for Values of $\frac{x}{L}$.						Allowable Tension in Thousands of Pounds for One Angle for Values of $\frac{x}{L}$.					
l_1 In.	l_2 In.	t In.	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5	0.0	0.1	0.2	0.3	0.4	0.5
$3\frac{1}{2}$	$2\frac{1}{2}$	$\frac{3}{8}$	57.2	61.0	65.3	70.3	76.2	83.0	1.21	1.29	1.38	1.48	1.61	1.75	19.3	20.6	22.1	23.7	25.7	28.0
		$\frac{5}{16}$	57.5	61.1	65.5	70.4	76.2	82.9	1.02	1.09	1.17	1.25	1.36	1.47	16.3	17.4	18.7	20.0	21.7	23.5
		$\frac{1}{4}$	57.7	61.3	65.6	70.5	76.2	82.8	0.83	0.88	0.94	1.01	1.10	1.19	13.3	14.1	15.0	16.1	17.6	19.0
$2\frac{1}{2}$	$3\frac{1}{2}$	$\frac{1}{2}$	65.9	69.0	72.5	76.3	80.5	85.3	1.81	1.90	1.99	2.10	2.21	2.34	28.9	30.4	31.8	33.6	35.3	37.4
		$\frac{7}{16}$	66.0	69.1	72.5	76.3	80.4	85.1	1.60	1.68	1.76	1.85	1.95	2.07	25.6	26.9	28.1	29.6	31.2	33.1
		$\frac{3}{8}$	66.1	69.2	72.5	76.3	80.4	85.0	1.39	1.46	1.53	1.61	1.70	1.79	22.2	23.3	24.5	25.7	27.2	28.6
		$\frac{5}{16}$	66.2	69.2	72.6	76.2	80.3	84.8	1.18	1.23	1.29	1.36	1.43	1.51	18.9	19.7	20.6	21.7	22.9	24.1
		$\frac{1}{4}$	66.3	69.3	72.6	76.2	80.2	84.7	0.95	1.00	1.04	1.10	1.15	1.22	15.2	16.0	16.6	17.6	18.4	19.5
3	3	$\frac{1}{2}$	61.3	64.9	68.9	73.3	78.5	84.3	1.68	1.78	1.89	2.01	2.16	2.32	26.9	28.5	30.2	32.1	34.5	37.1
		$\frac{7}{16}$	61.5	65.0	69.0	73.3	78.4	84.2	1.49	1.58	1.68	1.78	1.90	2.05	23.8	25.3	26.9	28.5	30.4	32.8
		$\frac{3}{8}$	61.6	65.1	69.0	73.4	78.4	84.1	1.30	1.37	1.45	1.55	1.65	1.77	20.8	21.9	23.2	24.8	26.4	28.3

		5/16	61.8	65.3	69.1	73.4	78.3	84.0	1.10	1.16	1.23	1.31	1.39	1.49	17.6	18.5	19.7	20.9	22.2	23.8
		1/4	62.0	65.4	69.2	73.5	78.3	83.9	0.89	0.94	1.00	1.06	1.13	1.21	14.2	15.0	16.0	16.9	18.1	19.3
3	2½	3/8	57.9	61.5	65.6	70.2	75.6	81.9	1.11	1.18	1.26	1.35	1.45	1.57	17.7	18.9	20.1	21.6	23.2	25.1
		5/16	58.1	61.7	65.7	70.3	75.6	81.8	0.94	1.00	1.06	1.14	1.22	1.32	15.0	16.0	16.9	18.2	19.5	21.1
		1/4	58.3	61.9	65.8	70.4	75.6	81.7	0.76	0.81	0.86	0.92	0.99	1.07	12.1	12.9	13.7	14.7	15.8	17.1
2½	3	3/8	62.8	66.0	69.6	73.5	78.0	83.0	1.20	1.27	1.34	1.41	1.50	1.59	19.2	20.3	21.4	22.5	24.0	25.4
		5/16	62.9	66.1	69.6	73.5	78.0	82.9	1.02	1.07	1.13	1.19	1.26	1.34	16.3	17.1	18.1	19.0	20.1	21.4
		1/4	63.1	66.3	69.7	73.6	78.0	82.8	0.83	0.87	0.91	0.96	1.02	1.08	13.3	13.9	14.5	15.3	16.3	17.3
2½	2½	3/8	58.8	62.2	65.9	70.1	75.0	80.5	1.02	1.08	1.14	1.21	1.30	1.39	16.3	17.3	18.2	19.3	20.8	22.2
		5/16	59.0	62.3	66.0	70.2	75.0	80.5	0.87	0.92	0.97	1.03	1.10	1.18	13.9	14.7	15.5	16.5	17.6	18.9
		1/4	59.2	62.5	66.1	70.3	75.0	80.4	0.70	0.74	0.78	0.84	0.89	0.96	11.2	11.8	12.5	13.4	14.2	15.3
		3/16	59.4	62.6	66.2	70.4	75.0	80.4	0.53	0.57	0.60	0.63	0.76	0.72	8.5	9.1	9.6	10.1	10.7	11.5
2½	2	3/8	53.7	57.2	61.2	65.7	71.0	77.1	0.83	0.89	0.95	1.02	1.10	1.19	13.3	14.2	15.2	16.3	17.6	19.0
		5/16	54.0	57.5	61.4	65.9	71.0	77.1	0.71	0.75	0.80	0.86	0.93	1.01	11.3	12.0	12.8	13.7	14.9	16.1
		1/4	54.4	57.8	61.6	66.1	71.0	77.1	0.58	0.61	0.65	0.70	0.75	0.82	9.3	9.8	10.4	11.2	12.0	13.1
		3/16	54.7	58.1	61.8	66.3	71.0	77.1	0.44	0.47	0.50	0.54	0.57	0.62	7.0	7.5	8.0	8.6	9.1	9.9
2	2½	3/8	59.8	62.9	66.2	70.0	74.2	79.0	0.93	0.97	1.03	1.08	1.15	1.22	14.9	15.5	16.5	17.3	18.4	19.5
		5/16	60.0	63.1	66.4	70.1	74.2	79.0	0.79	0.83	0.87	0.92	0.97	1.03	12.6	13.3	13.9	14.7	15.5	16.5
		1/4	60.3	63.3	66.5	70.2	74.2	78.9	0.64	0.67	0.70	0.74	0.79	0.84	10.2	10.7	11.2	11.8	12.6	13.4
		3/16	60.5	63.5	66.7	70.3	74.2	78.9	0.49	0.51	0.54	0.57	0.60	0.64	7.8	8.2	8.6	9.1	9.6	10.2
2	2	3/8	54.3	57.5	61.0	65.1	69.7	75.0	0.74	0.78	0.83	0.88	0.95	1.02	11.8	12.5	13.3	14.1	15.2	16.3
		5/16	54.7	57.8	61.3	65.3	69.8	75.0	0.63	0.66	0.70	0.75	0.80	0.86	10.1	10.5	11.2	12.0	12.8	13.7
		1/4	55.1	58.1	61.5	65.5	69.9	75.0	0.52	0.55	0.58	0.62	0.66	0.70	8.3	8.8	9.3	9.9	10.5	11.2
		3/16	55.5	58.4	61.8	65.7	70.0	75.0	0.39	0.41	0.44	0.47	0.50	0.53	6.2	6.5	7.0	7.5	8.0	8.5
1½	2	5/16	55.4	58.1	61.1	64.5	68.2	72.4	0.55	0.58	0.61	0.64	0.68	0.72	8.8	9.3	9.7	10.2	10.9	11.5
		1/4	55.8	58.5	61.4	64.7	68.3	72.5	0.45	0.47	0.50	0.52	0.55	0.59	7.2	7.5	8.0	8.3	8.8	9.4
		3/16	56.2	58.9	61.7	64.9	68.4	72.6	0.35	0.36	0.38	0.40	0.42	0.45	5.6	5.7	6.1	6.4	6.7	7.2

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