Unless a larger coefficient can be justified by tests or other criteria, the following values of \( U \) shall be used:

- when \( l > 2w \), \( U = 1.0 \);
- when \( 2w > l > 1.5w \), \( U = 0.87 \);
- when \( 1.5w > l > w \), \( U = 0.75 \)

where

\[
  l = \text{weld length, in. (mm)} \\
  w = \text{plate width (distance between welds), in. (mm)}
\]

\( U \) is the effective coefficient.

\(-e\) Bolted splice and gusset plates, and other connection fittings subject to tensile forces shall be designed in accordance with the provisions of NF-3322.1(a) where the effective net area shall be taken as the actual net area, except that for the purpose of design calculations it shall not be taken as greater than 85% of the gross area.

\((2)\) Size of Bolt Holes. In computing net area, the diameter of a bolt hole shall be taken as \( \frac{7}{16} \) in. (1.5 mm) greater than the nominal dimension of the hole normal to the direction of applied stress.

\((3)\) Angles. For angles, the gross width shall be the sum of the widths of the legs less the thickness. The gage for holes in opposite legs shall be the sum of the gages from the back of angles less the thickness.

\((4)\) Pin-Connected Members

\(-a\) The available tensile strength of eyebars, as shown in Figure NF-3322.8-1, shall be determined in accordance with NF-3322.1(a), with the gross area taken as the cross-sectional area of the body. For calculation purposes, the width of the body of the eyebars shall not exceed 8 times its thickness. Eyebars shall be of uniform thickness, without reinforcement at the pin holes, and have circular heads with the periphery concentric with the pin hole. The radius of transition between the circular head and the eyebar body shall not be less than the head diameter. The pin diameter shall be not less than \( \frac{7}{6} \) times the eyebar body width, and the pin hole diameter shall be not more than \( \frac{1}{32} \) in. (0.8 mm) greater than the pin diameter. For steels having specified minimum yield stress greater than 70.0 ksi (485 MPa), the hole diameter shall not exceed 5 times the plate thickness, and the width of the eyebar body shall be reduced accordingly. A thickness of less than \( \frac{7}{8} \) in. (13 mm) is permissible only if external nuts are provided to tighten pin plates and filler plates into snug contact. The width from the hole edge to the plate edge perpendicular to the direction of applied load shall be greater than two-thirds and, for the purpose of calculation, not more than \( \frac{3}{4} \) times the eyebar body width.

NOTE: Members having a different thickness at the pinhole location are termed built-up.

\(-b\) In pin-connected plates other than eyebars, as shown in Figure NF-3322.8-2, the tensile stress on the net effective area and on the gross section shall be determined in accordance with NF-3322.1(a). The shear stress on the minimum net area beyond the pinhole shall not exceed the stress allowed in NF-3322.1(b). The bearing stress on the projected area of the pin shall not exceed the stress allowed in NF-3322.1(f)(1).

\(-c\) The distance used in calculations, transverse to the axis of pin-connected plates other than eyebars or any individual element of a built-up member, from the edge of the pinhole to the edge of the member or element shall not exceed 2 times the thickness of the plate plus \( \frac{7}{6} \) in. (16 mm), but not more than the actual distance from the edge of the pinhole to the edge of the part measured in the direction normal to the applied force. Members having a different thickness at the pinhole location are termed “built-up.” The effective net area in shear is 2 times the thickness of the member times the calculated distance transverse to the axis of the member from the edge of the pinhole to the edge of the member. The effective net area in shear is 2 times the thickness of the member times the shortest distance from the center of the pin to the edge of the member measured parallel to the direction of the force.

**Figure NF-3322.8-1**

**Dimensional Requirements for Eyebars**

\[
\begin{align*}
  d_h + 2b & \\
  b & \\
  w &
\end{align*}
\]

\[
\begin{align*}
  R & \\
  b & \geq \frac{7}{8}w \text{ but } \leq \frac{7}{4}w \text{ (upper limit is for calculation purposes only)} \\
  d & \geq \frac{7}{8}w \\
  d_h & \leq d + \frac{7}{8} \text{ in. } (d + 0.8 \text{ mm}) \text{, and if } S_y > 70.0 \text{ ksi } (485 \text{ MPa}), \text{ then } d_h \leq 5t \\
  t & \geq \frac{7}{8} \text{ in. } (13 \text{ mm}) \text{ (Exception is provided in NF-3322.8(c)(4)(-a))} \\
  w & \leq 8t \text{ (for calculation purposes only)}
\end{align*}
\]

GENERAL NOTE: Dimensional requirements for eyebars are as follows:

For ASME committee use only
Figure NF-3322.8-2

Dimensional Requirements for Pin-Connected Plates

GENERAL NOTE: Dimensional requirements for pin-connected plates are as follows:

\[ a \geq 1.33b_e \]
\[ b \geq b_e \]
\[ b_e = 2t + \frac{5}{8} \text{ in.} \quad (2t + 16 \text{ mm}) \]
\[ c \geq a \]
\[ d_h \leq d + \frac{\gamma}{52} \text{ in.} \quad (d + 0.8 \text{ mm}) \]
\[ w \geq 2b_e + d \]

(-d) In pin-connected plates other than eyebars, the pinhole shall be located midway between the edges of the member in the direction normal to the applied force. When the pin is expected to provide for relative movement between connected parts while under full load, the diameter of the pinhole shall be not more than \( \frac{1}{52} \text{ in.} \) (0.8 mm) greater than the diameter of the pin. The width of the plate at the pinhole, transverse to the axis of the member, and the minimum extension beyond the bearing end of the pinhole, parallel to the axis of the member, shall not be less than that defined in Figure NF-3322.8-2. The corners beyond the pinhole may be cut at 45 deg to the axis of the member, provided the net area beyond the pinhole, on a plane perpendicular to the cut, is not less than that required beyond the pinhole parallel to the axis of the member.

NF-3323 Design Requirements for Steel Castings and Forgings

NF-3323.1 Allowable Stresses. Allowable stresses for steel castings and forgings shall be the same as those provided in NF-3322 with the applicable values for yield strength of Section II, Part D, Subpart 1, Table Y-1.

NF-3324 Design Requirements for Connections and Joints

NF-3324.1 General Requirements.

(a) Types of Connections Permitted. Structural Connections of a welded, bolted, or welded and bolted type shall be used.

Types of bolted connections include

(1) Friction-type connections that are mechanically fastened structural connections that use high-strength bolts (such as SA-325 and SA-490) and are sufficiently tightened to reliably produce a high clamping force that prevents slip between faying surfaces. Load is transferred at the faying surfaces by friction [Figure NF-3324.1(a)(1)].

(2) Bearing-type connections that are mechanically fastened structural connections that depend on direct shear of the fastener to transfer the load from one connected part to another.

(3) Other connections that are not covered by (1) and (2), such as clamps and U-bolts shown in Figure NF-1214-1, are not friction-type connections and shall meet the requirements of NF-3380, unless otherwise indicated in the design documents.

(b) Provision for Eccentric Connections. Axially stressed members meeting at a point shall have their gravity axes intersect at a point if practicable; if not, provision shall be made for bending stresses due to the eccentricity.

(c) Placement of Bolts and Welds. Except as otherwise provided, groups of bolts or welds at the ends of any member transmitting axial stress into that member shall have their centers of gravity on the gravity axis of the member, unless provision is made for the effect of the resulting eccentricity. Except in members subject to repeated variation in stress, as stipulated in NF-3330, disposition of fillet welds to balance the forces about the neutral axes for end connections of single angle, double angle, and similar type members is not required. Eccentricity between the gravity axes of such members and the gage lines for their bolted end connections may be neglected in statically loaded members, but should be considered in members subjected to fatigue loading.

NF-3324.2 Connection Design.

(a) Connections for Unrestrained Members