1.0 Bend Relief Designs

At intersections of bend lines, bend reliefs must be provided to prevent the material from tearing or wrinkling during the forming operation. See Figures 1 & 2 and Tables 1 & 2.

1.1 Types of Bend Reliefs

FIGURE 1 - NORMAL BEND RELIEF

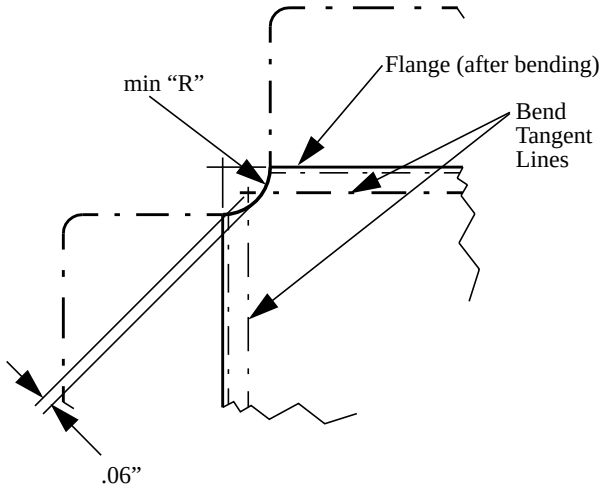

FIGURE 2 - SPECIAL BEND RELIEF

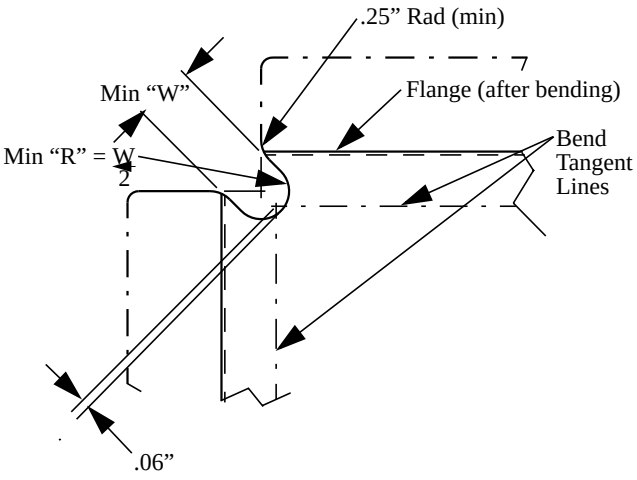

TABLE 1 - NORMAL BEND RELIEF RADII

Stock Thickness	Min "R"
.025" to .063"	.188"
.063" to .125"	.25"

TABLE 2 - SPECIAL BEND RELIEF RADII

Stock Thickness	Min "R"	Min "W"
.025" to .039"	.156"	.312"
.040" to .063"	.188"	.375"
.064" to .125"	.25"	.50"

When rivet pattern requires a longer flange.

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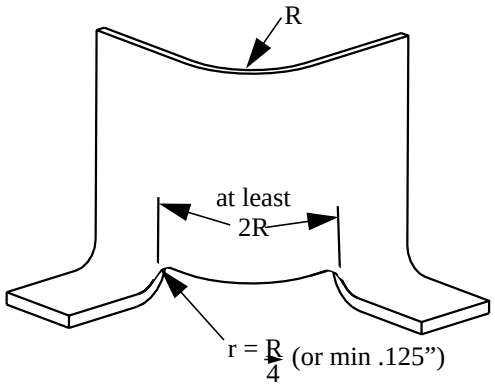
1.2 Bend Relief for Welded Corner Flanges

Welded parts such as boxes and lids that have the flanges corner welded use a standard relief hole of .125 inch diameter for all thicknesses. Any larger cut-out may prove difficult to fill with weld.

1.3 Cut-Away Flange for Bend Relief

For parts requiring the cut-away of a small portion of the flange for bend relief as shown in FIGURE 3, the cut-away portion at the corner should not be less than twice the radius (2R), otherwise cracking may occur in this area.

FIGURE 3 - CUT-AWAY FLANGE BEND RELIEF

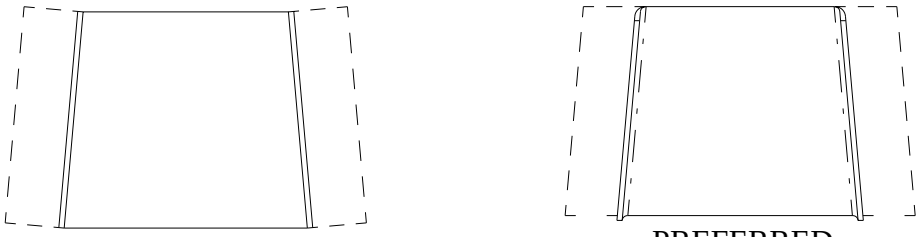


2.0 Design Considerations for Bending

2.1 Sheared Blanks

The design of a formed up part should permit the blank to be sheared. see Figure 4.

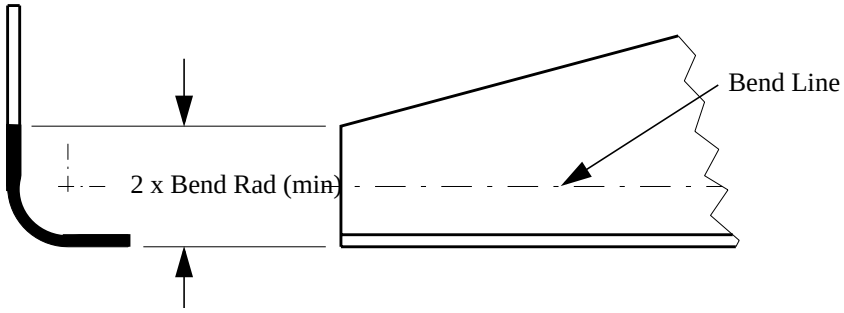
FIGURE 4 - BENDING DESIGN USING SHEARED BLANKS



2.2 Tapered Flange

Tapered flanges must not run off to a point. See Figure 5.

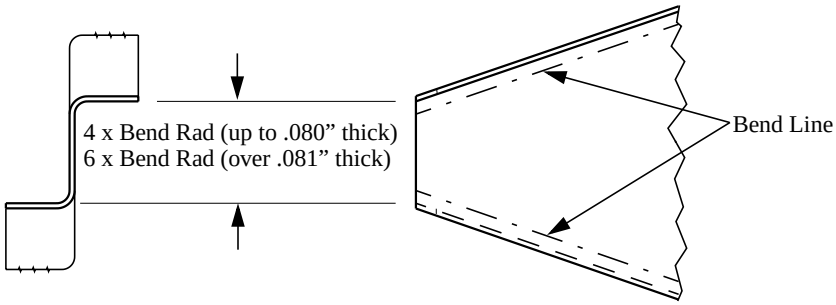
FIGURE 5 - TAPERED FLANGE



2.3 Double Tapered Flanges

Double tapered flanges must not run off to a point. see Figure 6.

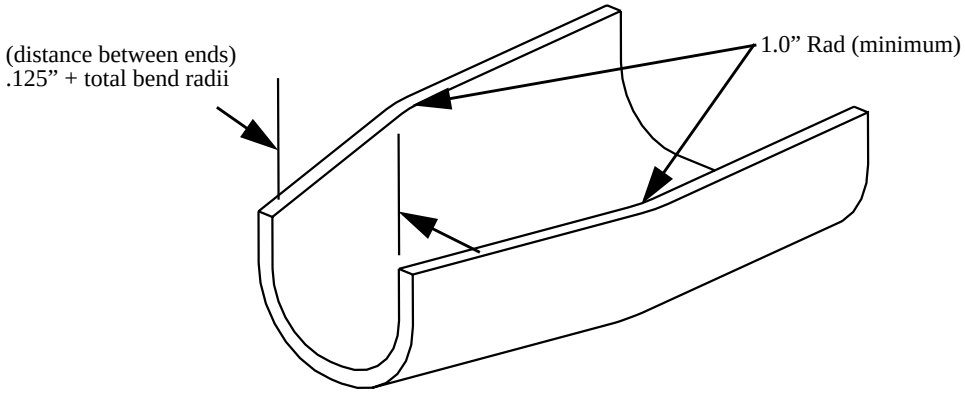
FIGURE 6 - DOUBLE TAPERED FLANGES



2.4 Converging Flanges

On converging bends of flanged parts, the distance between ends should be .125 inch + the total bend radii as shown to permit forming with sufficient allowance for dies, and a 1.0 inch minimum radius for the bend to prevent wrinkling. See Figure 7.

FIGURE 7 - CONVERGING FLANGES



2.5 Intercostals

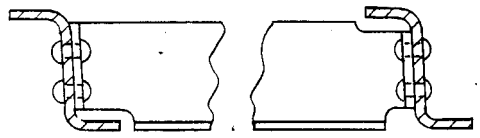
Type 1 method is preferred when one or both of the receiving member (such as ribs, stringers, longerons, frames or formers) shown in FIGURE 8 **are not** affected by any of the following limitations:

1) Do not require precise locating from a design point of view.

2) Do not require jig locating.

3) Are not too rigid to be flexed.

FIGURE 8 - TYPE 1 METHOD



Type 2 method is to be used when both of the receiving members shown in FIGURE 9 **are** affected by any of the following limitations:

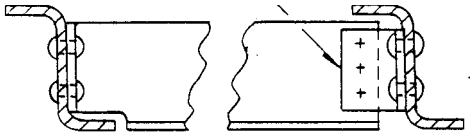
1) Do require precise locating.

2) Do required jig locating.

3) are too rigid for adequate flexing.

FIGURE 9 - TYPE 2 METHOD

SEPERATE BRACKET



2.6 Return Lip Flange

For return lip flange, drawings shall specify the dimension “X” and not “Y” as the critical dimension. See figure 10. In order to reduce tooling cost, dimension “X” is necessary to have the following measurements: .375”, .500”, .625”, .750”, 1.00”, 1.25”, 1.50”, 1.75” or 2.00 inches.

FIGURE 10 - RETURN LIP FLANGE