Column Splices

1. INTRODUCTION

AISC specifies that, where full-milled tier-building columns are spliced, there shall be sufficient welding to hold them securely in place. These connections shall be proportioned to resist any horizontal shear forces, and any tension that would be developed by specified wind forces acting in conjunction with 75% of the calculated dead load stress and no live load, if this condition will produce more tension than full dead load and live load applied. (AISC Sec 1.15.8).

Figures 1 and 2 show various designs of column splices which eliminate punching of the columns. Note that these details require only handling and punching of small pieces of angles or plates which are easily carried to, and welded to, the columns in the shop. The details provide for temporary bolted connections in the field prior to making the permanent welded connections.

Sometimes the column connections are placed about midway in height, in order to get the connection away from the region of heavy bending moment caused by windloads, etc. The result is a connection sufficient to hold the columns in place and designed for horizontal shear and axial compression only.

2. TYPES OF SPLICES

In Figure 1(a), a plate and two angles are punched or, if necessary, drilled. The plate is shop welded to the top of the lower column. The two angles are shop welded to the web at the lower end of the upper column. The upper column is erected on top of the lower column and erection bolts are inserted. The upper column is then field welded to the connecting plate. Where additional clearance is needed for erection of beams framing into the web of the lower column, it might be necessary to shop weld the plate to the upper column and then field weld in the overhead position to the lower column.

If the upper and lower columns differ in size, the connecting plate is designed as a member in bending due to misalignment of the flanges, and its thickness is determined from this; Figure 1(b). If the lower column's section is much deeper than the upper column, stiffeners can be welded directly below the flanges of the upper column. These stiffeners will reduce the required thickness of the connecting plate; Figure 1(c).

A splice for heavy columns is shown in Figure 1(d). Two small plates are punched with holes aligned as indicated. They are then carried to the column sec-

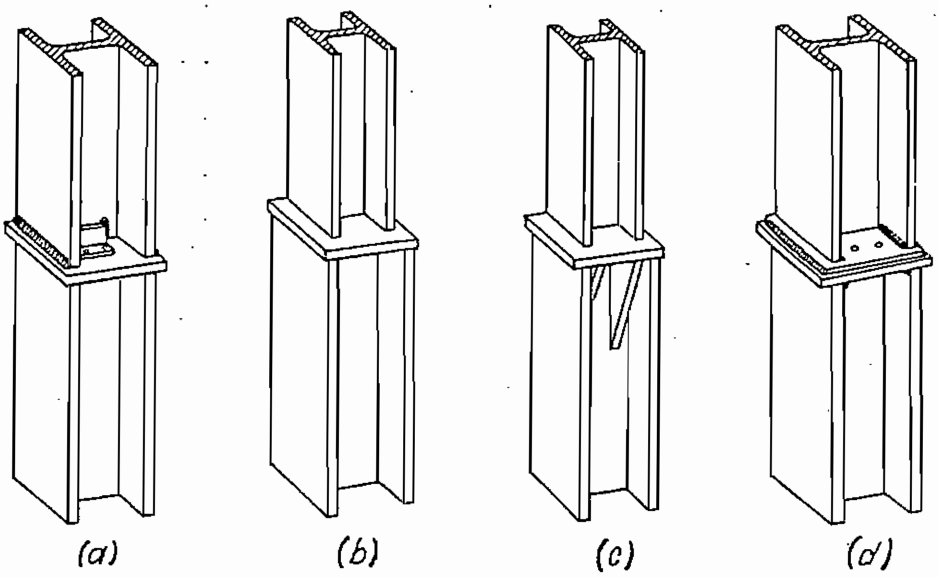

FIG. 1—Typical Column Splices

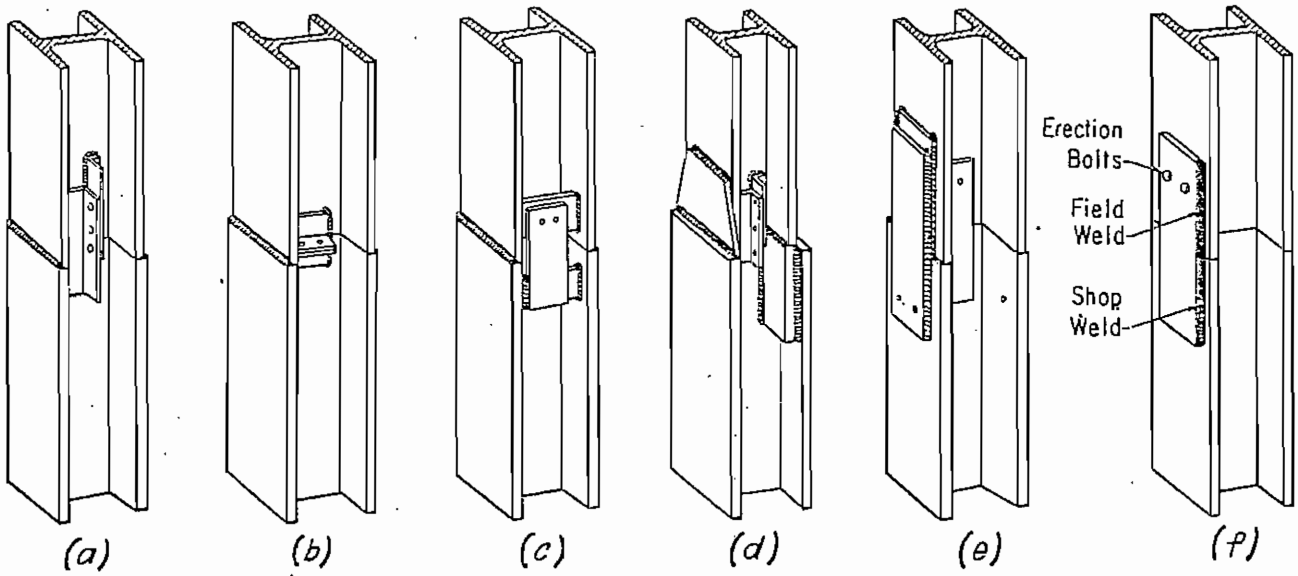

FIG. 2 — Typical Column Splices

tions and welded thereto. In the field the column sections are bolted temporarily prior to welding, as indicated at (d).

In Figure 2(a) the ends of both column sections are first milled for a square bearing surface. Then the two lower erection splice angles are shop welded on opposite sides of the web of the heavier column section, so as to project past the end of the column. The outstanding legs of these angles are provided with holes for erection bolts to engage the outstanding legs of the other two angles that are shop welded to the upper column section. In this type of detail where lighter connecting material projects from heavy main sections, care should be taken in handling to prevent damage to the lighter material.

The flanges on the lower end of the upper column section are partially beveled or "J" grooved, and this partial penetration groove joint is then welded in the field.

The purpose of the angles is to splice and hold the two adjacent columns together temporarily while they are being field welded.

These erecting angles may be placed horizontally on the web of the columns, Figure 2(b). The advantage of this position is that they do not extend beyond the ends of the column for possible damage during transit or erection.

Four plates are punched, then shop welded between the flanges of the two column sections as shown in Figure 2(c), leaving enough space between the back of the plates and the column web to insert a wrench. Two splice plates are also punched and shop welded to the lower column section before shipping to the erection site. After bolting in the field as indicated, the permanent connection is made by welding.

The splice in Figure 2(d) is similar to that at (a) but is for connecting two columns of different sizes. The flanges of the upper column lie inside of the flanges of the lower column. Before shop welding the erecting angles, splice plates are first shop fillet welded to the inside face of the flange of the lower column. They are milled with the lower column section. As an alternate to this, splice plates with their lower edges prepared for welding are shop fillet welded to the outside face of the flanges on the upper column.

In case only one side of the column is accessible, for example when new steel is erected adjacent to an old structure, a combination of this procedure may be used. Place the lower splice plates on the inside face of the lower column and the upper splice plate on the outside face of the upper column; See Figure 2(d). In this manner all field welds on both column flanges can be made from the one side.

Where splice plates are used and filler plates are needed because of the difference in sizes of the upper and lower columns, these plates are welded to the upper column. See Figure 2(e). This allows the greater amount of welding to be done in the shop where larger electrodes and higher welding currents used in

TABLE 1—Allowables for Weld Metal in Partial-Penetration Groove Welds *For Field Splices of Columns*

	E60 Welds SAW-1	E70 Welds SAW-2
compression	same as plate	same as plate
tension transverse to cross-section of throat area	13,600 psi	15,800 psi
shear	13,600 psi	15,800 psi

AWS Building Par 205(a) and AISC Sec. 1.5.3

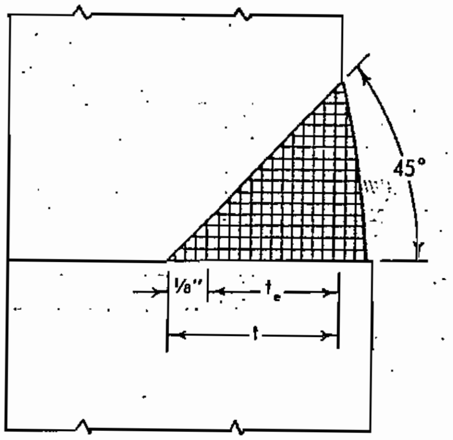

FIG. 3—Partial-Penetration Welds

the flat position result in higher welding speeds and lower cost. After erection the splice plate is field welded to the lower column.

Two attaching plates are shop welded to the upper end of the lower column. The column may be hoisted by attaching the cable to the erection holes of these plates. After erecting the upper columns, these plates are field welded to the upper column.

3. WELD ALLOWABLES

Both the AWS Building Code and the AISC Specifications allow partial-penetration groove welds, either a bevel or a J preparation, to be used on column field splices.

For a J joint, the effective throat (t_e) is equal to the actual throat (t).

For a beveled joint, the effective throat (t_e) equals the actual throat (t) less ⅛". This reduction in throat is made because the weld may not extend all the way down into the very root of the joint. The ⅛" reduction is very conservative. No reduction is made in the throat of the J preparation because there is no problem in reaching the root of the joint.

A beveled joint is usually flame cut along the end of the column flange. A J groove must be machined or else gouged out by the air carbon-arc process. Although it may seem that the beveled groove might require more weld metal because it must be ⅛" deeper than required, the J groove on the other hand must start with a ⅜" radius and an included angle of 45°. There may be no reduction in the amount of weld metal by using the J groove; see Figure 3. A decision on joint design should be made only after all factors are carefully evaluated.

Since it is impossible to properly read radiographs of this partial penetration groove joint, because of the unwelded portion, these field splices should never be subject to radiographic inspection.

4. EXAMPLES

Figure 4 illustrates a typical field splice used on columns of the Detroit Bank & Trust Building in Detroit, Michigan. These fabricated columns were spliced by partial-penetration bevel joints in the column

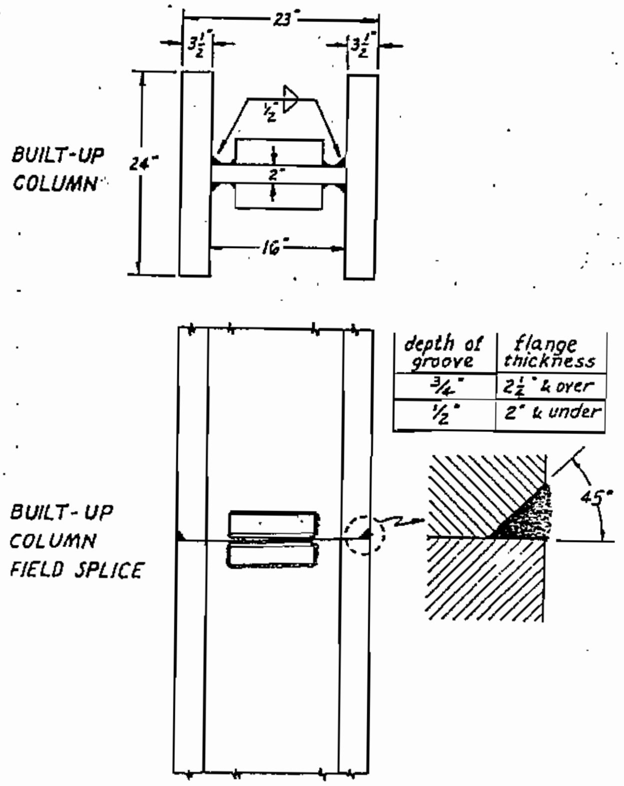

FIG. 4—Typical column splice on Detroit Bank & Trust Building.

flanges. These A36 steel columns were welded with E70 low-hydrogen electrodes. Notice the schedule of weld sizes. The angles were shop welded to column ends and field bolted during erection, using high-tensile bolts. These bolts were left in place and carried any horizontal shear in the direction of the column web, hence no field welding was required on the web of the columns.

Figure 5 illustrates the field splice of columns in the Michigan Consolidated Gas Co. Building in Detroit, Michigan. These fabricated A36 steel box-shaped columns were field welded with E70 low-hydrogen electrodes. Partial-penetration J-groove welds were used on all four flanges around the periphery of the column. Notice the schedule of weld sizes.

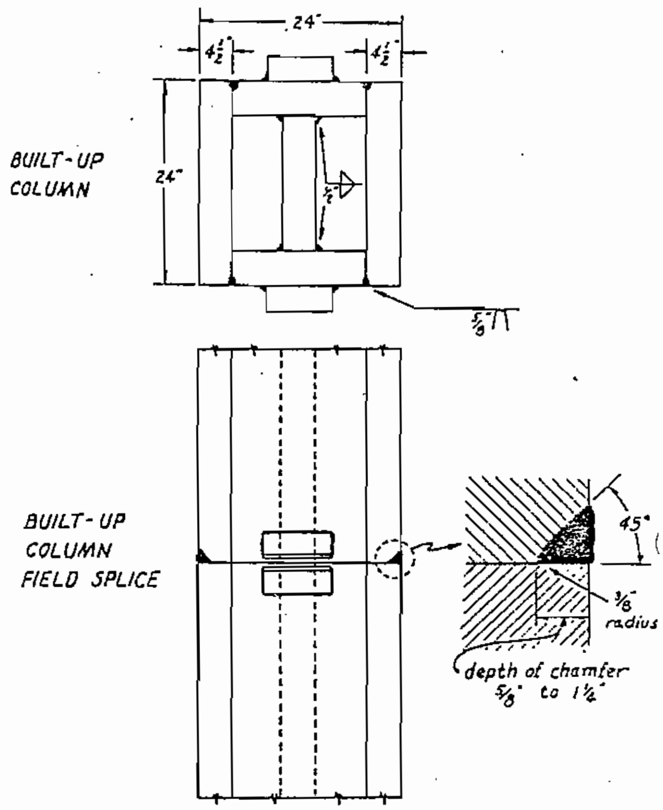

FIG. 5—Typical column splice on Michigan Consolidated Gas Co. Building.

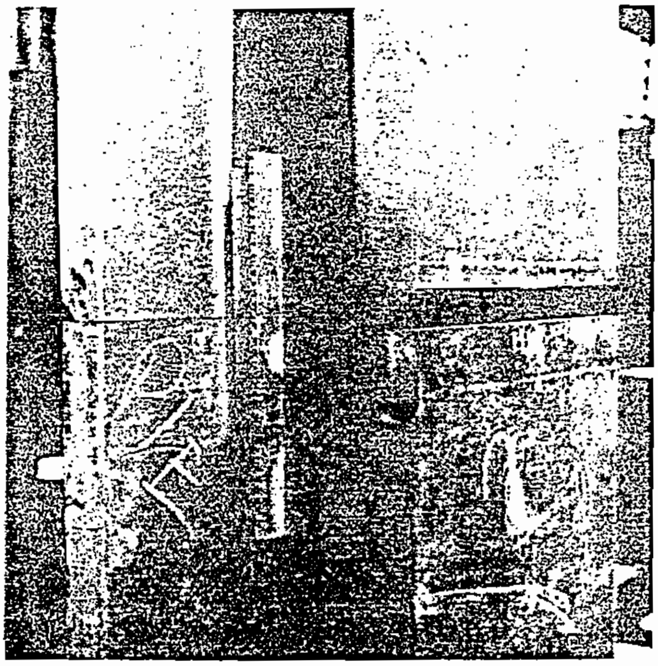

FIG. 6—Typical column splice in sections of same depth. Plate on the web is for bolting to facilitate erection.

FIG. 7—Field splicing of column flanges, using vapor-shielded arc welding process.