# CONTINUITY PLATES

**Based on AISC 360-16 J10.8 & AISC 341-16 E3.6f.2**

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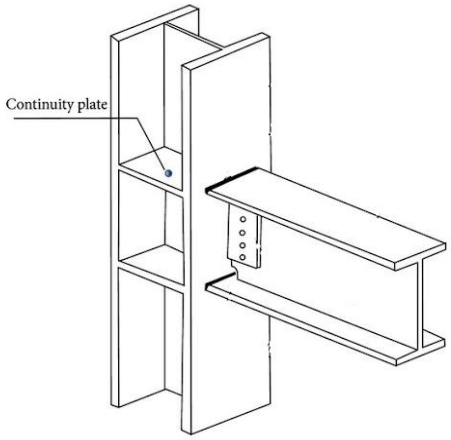
|---|---|---|---|---|---|
| **Client:** | | **Designed By:** | *A. Shaikhzadeh* | **Date:** | *27-Feb-21* |
| **Job Name:** | | **Verified By:** | | **Revision:** | *100%* |




| **DESIGN STATUS :** | **O.K.** |
|---|---|
| FLANGE LOCAL BENDING | **0.37** |
| WEB LOCAL YIELDING | **0.40** |
| WEB LOCAL CRIPPLING | **0.45** |
| WEB COMPRESSION BUCKLING | **0.94** |
| CONTINUITY PLATES REQUIRED | **YES** |
| CONTINUITY PLATES THICKNESS | **O.K.** |
| COMPRESSION BUCKLING | **0.13** |
| BEARING | **0.12** |



## DESIGN INPUT DATA

| | | | |
|---|---|---|---|
| FACTORED CONCENTRATED FORCE, $P$ | 100 | kN | |
| YEILD STRENGTH OF STEEL, $F_y$ | 240 | MPa | |
| MODULUS OF ELASTICITY OF STEEL, $E$ | 200000 | MPa | |
| COLUMN DEPTH, $d$ | 400 | mm | |
| COLUMN FLANGE WIDTH, $b_f$ | 200 | mm | |
| COLUMN FLANGE THICKNESS, $t_f$ | 20 | mm | |
| COLUMN WEB THICKNESS, $t_w$ | 8 | mm | |
| DISTANCE FROM FLANGE OUTER FACE TO FILLET TOE, $k$ | 20 | mm | |
| BEAM FLANGE WIDTH, $b_{bf}$ | 200 | mm | |
| BEAM FLANGE PLATE THICKNESS, $L_b$ | 30 | mm | |
| TYPE OF COLUMN | 1 | mm | END COLUMN |
| SHAPE OF COLUMN | 1 | | WIDE FLANGE COLUMN |
| TYPE OF CONNECTION | 2 | | TWO-SIDED CONNECTION |
| USE CONTINUITY PLATES | YES | | **PL 360 x 90 x 15 (TWO PLATES)** |
| THICKNESS OF CONTINUITY PLATE, $t_{cp}$ | 15 | mm | |
| WIDTH OF CONTINUITY PLATE, $b_{cp}$ | 90 | mm | |
| FILLET SIZE AT FLANGE-WEB CORNER | 5 | mm | |

## CONTROL OF COLUMN FLANGE THICKNESS

| | | | |
|---|---|---|---|
| $t_{lim} = b_{bf}/6$ or $b_{bf}/12$ | 33 | mm | Minimum thickness of column flange |
| $t_f > t_{lim}$ | **NO** | | **Continuity plates required based on thickness control** |

## FLANGE LOCAL BENDING

For Flange With Tensile Force

| | | | | |
|---|---|---|---|---|
| $x > 10\,t_f$ | NO | | End concentrated force | |
| $\phi$ | 0.9 | | Strength reduction factor | J10.1 |
| $\phi R_n$ | 270 | kN | Flange local bending strength | J10-1 |
| Status | **O.K.** | | | |
| D/C | **0.37** | | | |

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## WEB LOCAL YEILDING

| | | | | |
|---|---|---|---|---|
| $x > d$ | NO | | End concentrated force | |
| $\phi$ | 1.0 | | Strength reduction factor | J10.2 |
| $\phi R_n$ | 250 | kN | Web local yeilding strength | J10-3 |
| Status | **O.K.** | | | |
| D/C | **0.40** | | | |

## WEB LOCAL CRIPPLING

| | | | | |
|---|---|---|---|---|
| $x \geq d/2$ | NO | | End concentrated force | |
| $L_b/d$ | 0.08 | | | |
| $\phi$ | 0.75 | | Strength reduction factor | J10.3 |
| $Q_f$ | 1.0 | | 1.0 for wide-flange sections | J10.3 |
| $\phi R_n$ | N/A | kN | Strength based on Equation J10-4 | |
| $\phi R_n$ | 222 | kN | Strength based on Equation J10-5a | |
| $\phi R_n$ | N/A | kN | Strength based on Equation J10-5b | |
| Status | **O.K.** | | | |
| D/C | **0.45** | | | |

## WEB COMPRESSION BUCKLING

| | | | | |
|---|---|---|---|---|
| $x \geq d/2$ | NO | | End concentrated force | |
| $\phi$ | 0.90 | | Strength reduction factor | J10.5 |
| $Q_f$ | 1.0 | | 1.0 for wide-flange sections | J10.5 |
| $\phi R_n$ | 106 | kN | Strength of web compression buckling | J10-8 |
| Status | **O.K.** | | | |
| D/C | **0.94** | | | |

## CONTINUITY PLATES

SEE NOTE 4

### Compression Buckling

| | | | | | |
|---|---|---|---|---|---|
| $F = P - P_{resisted\ by\ other\ parts}$ | 100 | kN | | Force to be resisted by continuity plates (see note 4) | |
| $t_{cp} \geq 0.5\ t_f$ *or* $0.75\ t_f$ | **O.K.** | mm | | Control of minimum thickness of continuity plates | E3.6f.2 |
| $A_{cp} = 2\ x\ b_{cp}\ t_{cp}$ | 2700 | mm$^2$ | | Area of continuity plate (one plate) | |
| $I_{cp}$ | 8305200 | mm$^4$ | | Moment of inertia of the two continuity plates about beam longitudinal axis | |
| $L_w$ | 96 | mm | | Effective strip of the web allowed to be used | J10.8 |
| $A_w = L_w\ t_w$ | 768 | mm$^2$ | | Area of the effective web strip | |
| $I_w$ | 4096 | mm$^4$ | | Moment of inertia of the effective web strip about beam longitudinal axis | |
| $A_{total} = A_{cp} + A_w$ | 3468 | mm$^2$ | | Total area of continuity plates and effective web strip | |
| $I_{total} = I_{cp} + I_w$ | 8309296 | mm$^4$ | | Total moment of inertia of continuity plates and effective web strip | |
| $r = (I_{total} / A_{total})^{0.5}$ | 49 | mm | | Radius of gyration | |
| $KL = 0.75\ h$ | 270 | mm | | Effective length | J10.8 |
| $KL/r$ | 6 | | < | 25 (see note 2) | |
| $\phi R_n = 0.9\ F_y\ A_{total}$ | 749 | kN | | Compression buckling strength | J4.4 |
| Status | **O.K.** | | | | |
| D/C | **0.13** | | | | |

### Bearing (Local Compressive Yeilding)

| | | | | |
|---|---|---|---|---|
| $\phi$ | 0.75 | | Strength reduction factor | J7 |
| $A_{cp,bearing}$ | 2550 | mm$^2$ | Bearing area (area of the two continuity plates, excluding the fillets) | |
| $\phi R_n = 1.8\ F_y\ A_{cp,bearing}$ | 826 | kN | Bearing strength | J7-1 |
| Status | **O.K.** | | | |
| D/C | **0.12** | | | |

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## CONTINUITY PLATES DETAILING REQUIREMENTS

E3.6f.2

**(a) Continuity-Plate Width**

The width of the continuity plate shall be determined as follows:

(1) For W-shape columns, continuity plates shall, at a minimum, extend from the column web to a point opposite the tips of the wider beam flanges.

(2) For boxed wide-flange columns, continuity plates shall extend the full width from column web to side plate of the column.

**(b) Continuity-Plate Thickness**

The minimum thickness of the plates shall be determined as follows:

(1) For one-sided connections, the continuity plate thickness shall be at least 50% of the thickness of the beam flange.

(2) For two-sided connections, the continuity plate thickness shall be at least equal to 75% of the thickness of the thicker beam flange on either side of the column.

**(c) Continuity-Plate Welding**

Continuity plates shall be welded to column flanges using CJP groove welds. Continuity plates shall be welded to column webs or extended doubler plates using groove welds or fillet welds.

NOTES:

1- N/A = Not Applicable

2- If $KL/r > 25$, provision of chapter E must be used for control of compression buckling. (360-16 J4.4)

3- Continuity plates are designed as short columns when they are provided to reinforce the web of a beam subjected to concentrated loads.

4- When continuity plates are not required but are selected to be used and designed, they are designed for the 100% of the factored concentrated force specified.
However, when continuity plates are required, the force used for their design is the total force minus the minimum force which can be tolerated by limit states
flange local bending, web local yielding, web local crippling and web compression buckling.