STEEL TUBE INSTITUTE

HSS Connex User Notes

1. This version of HSS Connex is based on the AISC 360-2016 Specification and 15th Ed. Manual, with the exception of the following:
    a. Q_f is based on the AISC 360-22 Specification Section K1.3.
    b. Refer to HSS Connex User Note 11 for the basis of connection end distance requirements.
2. ASTM A500 Grade C in HSS Connex utilizes Fy = 50 ksi for square, rectangular, and round HSS per ASTM A500-23.
3. ASTM A1085 in HSS Connex utilizes Fy = 50 ksi for square, rectangular, and round HSS per ASTM A1085-22.
4. To check a design with an A500 grade B section, choose a custom material and manually enter the value of F_y and F_u.
5. If checking a custom shape based on the A500 specification, enter the design thickness (0.93 x the nominal thickness), not the nominal thickness, per introduction to 16th Ed. Manual Tables 1-11 through 1-13.
6. For A1085 sections selected in HSS Connex, the default wall design thickness is based on the full nominal thickness without any reductions taken per introduction to 16th Ed. Manual Tables 1-11 through 1-13.
7. For rectangular HSS, "Orientation" configurations are as follows:
    a. Chord
        i. Vertical: Branch/plate connects to narrow face of chord.
        ii. Horizontal: Branch/plate connects to wide face of chord.
    b. Branches
        i. $H_b > B_b$: Wide face of branch is parallel to the chord axis.
        ii. $B_b > H_b$: Wide face of branch is perpendicular to the chord axis.
8. When inputting HSS chord or HSS branch sections, a warning may appear that the limit of applicability related to HSS wall slenderness (B/t or D/t) has not been met. If this prompt appears, select an HSS section such that the HSS connecting wall exceeds the wall slenderness limit (i.e. increase wall thickness and/or decrease wall width). Alternately, the HSS wall can be reinforced with plates per HSS Connex User Note 19. See below for additional information on wall slenderness limits:
    a. For Transverse, Longitudinal Plate, and Longitudinal Through Plate-to-Rectangular HSS Connections, the wall slenderness, B/t, of the connecting HSS wall shall be less than or equal to 30 in order to calculate Q_f per the 15th Ed. Manual pp. 9-15.

b. For Transverse Plate, and Longitudinal Through Plate-to-Round HSS Connections, the wall slenderness, D/t, shall be less than or equal to 50 per AISC 360-16, Table K2.1A.
c. For Round HSS-to-Round HSS Connections, the wall slenderness, D/t, shall be less than or equal to 50 per AISC 360-16, Table K3.1A or K4.1A.
d. For Rectangular HSS-to-Rectangular HSS Connections:
    i. At connections where the branch member imposes an axial load onto the chord member, refer to Table K3.2A for chord wall and branch wall slenderness limits for T-, Y-, Cross-, Gapped K-, and Overlapped K-Connections
    ii. At connections where the branch member imposes a moment onto the chord member, refer to Table K4.2A for chord wall and branch wall slenderness limits for T- and Cross Connections

9. After inputting HSS chord member geometry, an input section appears titled "Chord Stress Interaction Parameter, Q_f" which accounts for the global axial-moment utilization of the HSS column/chord member and its effect on local connection stresses. The axial and moment input fields correspond to the forces in the HSS column/chord to the left and right of the connection joint. Positive axial forces indicate tension in the chord connecting face, and negative axial forces indicate compression. Positive moment indicates clockwise moment in the HSS chord, and negative indicates counter-clockwise moment. The axial force and moment inputs determine the chord stress interaction parameter, Qf.
10. Refer to AISC 360-22 Section K1.3 and corresponding Commentary for discussion of and equations used to determine the chord stress interaction parameter, Q_f. This term has a value of 1.0 if the HSS connecting surface is in tension and a value less than or equal to unity if the chord connecting surface is in compression.
11. If a minimum distance to an unreinforced end of the chord/main HSS member, l_{end}, does not exist on each side of a connection, the available strength of the chord is reduced by 50% per AISC 360-22 Specification Section K1.4. The calculations for minimum end distance for rectangular and round HSS are shown in AISC 360-22 Equations K1-7 and K1-8, respectively.
12. If the "End Of Member" section shows an end distance of "XX inches," verify all inputs in the Chord and Branches or Plate sections are complete.
13. For Transverse Plate-to-HSS connections, HSS Connex currently allows the plate to be 90 degrees to the chord only—other angles are not currently supported.
14. For Plate-to-HSS connections under shear load, check HSS wall rupture at the weld per the 16th Edition Manual Equation 9-6 or 9-7. Refer also to AISC Design Guide 24, 2nd Edition, Table 3-3 for minimum HSS wall thickness to develop a range of weld sizes. HSS Connex does not design welds and therefore does not run this check.

15. For Longitudinal Plate-to-HSS connections, "Bolt Eccentricity" is equal to "e" in the 16th Edition Manual Table 10-9 for conventional single plate connections, and is equal to "e" per 16th Edition Manual Figure 10-13 for extended single plate connections.
16. Cap Plate Connections: This calculation assumes a stem/transverse plate transfers an axial load to a cap plate welded to the end of an HSS member. This is similar to a wide flange beam bearing on top of an HSS column with a cap plate, with the wide flange beam web acting as the stem/transverse plate. Refer to Figure 1. Input the stem/transverse plate thickness (or bearing length, l_b) and cap plate thickness, t_p.

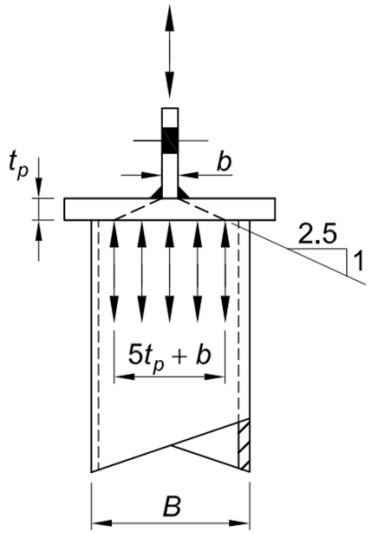

Fig. 1 Cap Plate Connection in HSS Connex
Source: AISC 360-22 Commentary Fig C-K2.2

17. Cap Plate Connections: HSS Connex considers shear lag in the connection. Refer to STI Technical Article on HSS Limit States in Cap Plate Connections for additional discussion.
    c. If (5tp + lb) < B, only two HSS walls are engaged to resist the concentrated load
    d. If (5tp + lb) > B, the full HSS section is effective in resisting the concentrated load

18. For HSS-to-HSS Connections, if a 2-branch connection is selected, results will not be shown if information is input for only one branch. For this configuration, choose a single-branch connection.
19. If it is found that the HSS section is inadequate at the connection, it is recommended to increase the HSS wall thickness. Alternately, the HSS wall can be reinforced with plates. Refer to the STI Technical Article on Plate-Reinforced HSS Connections and the webinar recording on Reinforcing HSS Connections.