File :   Kieffer1033c.mcd

Site :   Hampton Inn & Suites
      5740 North State Road 7
      Coconut Creek, Florida 33073

Sign Type :   4'-0" tall x 5" deep x 36'-1 1/8" overall length script 'Hampton Inn & Suites' LED channel letters all mounted
               with double angle clips with remote power supplies for installation on the South elevation of the building.
               Drawing No. 1404058 rev. A

Design loads are based on the 2010 Florida Building Code (ASCE 7-10) using Exposure C and 170 mph winds.

Design Wind Speed : (mph.) $V := 170.0$ Based on Risk Category II

Velocity Pressure Coefficient at a Height of Less Than 80', Exposure C : $Kz := 1.21$ Based on Table 30.3-1

Topographic Factor : $Kzt := 1.00$ Based on Table 26.8-1

Wind Directionality Factor : $Kd := 0.85$ Based on Table 26.6-1

Velocity Pressure : (PSF) $qz := 0.00256 Kz \cdot Kzt \cdot Kd \cdot V^2$ $qz = 76.093$ Based on 30.3-1

Combined Extenal Pressure GCp (30.4-1) minus Internal Pressure GCpi (26.11-1) : $GC_{Comb} := 1.65$

Load Combination Factor : $LCF := 0.60$ Based on 2.4.1, Case 7

Design Pressure : (PSF) $F := qz \cdot GC_{Comb} LCF$ $F = 75.332$ Use : $WL := 75.4$

Design Snow Load : (PSF) $SL := 0.0$ N/A

Reference :   Manual of Steel Construction, AISC 13th Edition.

Mounting Angles :   ASTM A-36   Fy = 36.0 ksi. ;   Fb = 23.76 ksi. ;   Fv = 14.40 ksi.

Mounting Bolts :   18-8 Stainless Steel   Fu = 60.0 ksi. ;   Ft = 20.00 ksi. ;   Fv = 10.00 ksi.
                               (Threads included in shear plane.)

     <u>Design Loads for the Individual Letters 'H', 'I' and 'S' and the Symbol '&' :</u>

        <u>Dead Load - Based on the Letter 'H' - Heaviest :</u>

Based on 4.5 lbs./sq.ft. : $ShrDL := (4.0 \cdot 4.75) \cdot 4.5$ $ShrDL = 85.5$ lbs.

        <u>Wind Load - Based on the Letter 'H' :</u>

5" Deep Letter plus Mounting Angles : $ShrWL := \left[4.0 \cdot 2.33 \cdot \left(\dfrac{5.0 + 2.375}{12} \right) \right] \cdot WL$ $ShrWL = 431.885$ lbs.

        <u>Snow Load - Based on the Letter 'H' :</u>

All Exposed Surfaces : $ShrSL := \left[4.75 \cdot 1.67 \cdot \left(\dfrac{5.0 + 2.375}{12} \right) \right] \cdot SL$ $ShrSL = 0$ lbs.

        <u>Combined Shear :</u>

Summation : (lbs.) $ShrLtr := \sqrt{ \left[(ShrDL + ShrWL)^2 + (ShrWL + ShrSL)^2 \right] }$ $ShrLtr = 673.952$

     <u>Design of Mounting Bolts for the Individual Letters 'H', 'I' and 'S' and the Symbol '&' :</u>

Mounting Bolt Diameter : (in.) $MntBltDia := 0.375$

Stress Area : (in.^{2})
(Based on nominal diameter per AISC 4-3)

$$MntBltArea := \frac{\pi \cdot MntBltDia^2}{4} \qquad MntBltArea = 0.11$$

Allowable Tension : (lbs.) $AllwTen := 20000 \cdot MntBltArea \qquad AllwTen = 2209$

Allowable Shear : (lbs.) $AllwShr := 10000 \cdot MntBltArea \qquad AllwShr = 1104$

Minimum Number of Mounting Bolts in Shear per Letter : $NoShr := 4$
(The letter 'H' has eight mounting bolts, the letter 'I' has six, the letter 'S' has five, and the '&' symbol has four.)

Shear per Mounting Bolt : (lbs.) $ShrMntBlt := \dfrac{ShrLtr}{NoShr} \qquad ShrMntBlt = 168.488$

minimum Number of Mounting Bolts in Tension per Letter : $NoTen := 2$

Minimum Distance Between Mounting Bolts : (in.) $LvrArm := 17.75$

Tension Load per Mounting Bolt : (lbs.) $TenMntBlt := \dfrac{(ShrLtr) \cdot (5.0 + 2.375)}{NoTen \cdot LvrArm} \qquad TenMntBlt = 140.01$

Unity Check :
Mounting Bolts $UCMntBlt := \dfrac{ShrMntBlt}{AllwShr} + \dfrac{TenMntBlt}{AllwTen} \qquad UCMntBlt = 0.216 \quad < \quad 1.00 \qquad OK$

> Note :   Use 3/8" diameter 18-8 Stainless Steel bolt, with spacers thru EIFS, as listed :
>
> Expansion bolts in concrete or brick walls.
>
> Toggle bolts in concrete block or panel walls.
>
> TEK screws in metal studs.
>
> Lag bolts in wood studs.
>
> All thread bolts with blocking between studs.

> Design of Mounting Angles for the Individual Letters 'H', 'I' and 'S' and the Symbol '&' :

Angle Thickness : (in.) $AngleThk := 0.1875$ Angle Length : (in.) $AngleLngth := 2.0$

Angle Specimen : (in.) $PLS := (2.0 - 0.75) \qquad PLS = 1.25$

Minimum Angle Thickness Required : (in.) $ReqdThk := \sqrt{\left[\dfrac{ShrMntBlt \cdot PLS \cdot 6}{(AngleLngth \cdot 23760)}\right]} \qquad ReqdThk = 0.163$

Unity Check - Angle Thickness : $UCAngThk := \dfrac{ReqdThk}{AngleThk} \qquad UCAngThk = 0.87 \quad < \quad 1.00 \qquad OK$

> Design Loads for the 'amp' Letter Set :

> Dead Load :

Based on 4.5 lbs./sq.ft. : $ShrDL := (2.25 \cdot 6.11) \cdot 4.5 \qquad ShrDL = 61.864$ lbs.

> Wind Load :

5" Deep Letter plus Mounting Angles : $ShrWL := \left[(3 \cdot 2.33) \cdot 2.25 \cdot \left(\dfrac{5.0 + 2.375}{12}\right)\right] \cdot WL \qquad ShrWL = 728.806$ lbs.

Snow Load :

All Exposed Surfaces : $\quad ShrSL := \left[6.11 \cdot 1.33 \cdot \left(\dfrac{5.0 + 2.375}{12} \right) \right] \cdot SL \quad ShrSL = 0 \quad$ lbs.

Combined Shear :

Summation : (lbs.) $\quad ShrTot := \sqrt{\left[(ShrDL + ShrWL)^2 + (ShrWL + ShrSL)^2 \right]} \quad ShrTot = 1075.321$

Design of Mounting Bolts for the 'amp' Letter Set :

Mounting Bolt Diameter : (in.) $\quad MntBltDia := 0.375$

Stress Area : (in.^{2}) $\quad\quad\quad\quad\quad\quad\quad MntBltArea := \dfrac{\pi \cdot MntBltDia^2}{4} \quad MntBltArea = 0.11$
(Based on nominal diameter per AISC 4-3)

Allowable Tension : (lbs.) $\quad AllwTen := 20000 \cdot MntBltArea \quad AllwTen = 2209$

Allowable Shear : (lbs.) $\quad AllwShr := 10000 \cdot MntBltArea \quad AllwShr = 1104$

Number of Mounting Bolts in Shear : $\quad NoShr := 11$

Shear per Mounting Bolt : (lbs.) $\quad ShrMntBlt := \dfrac{ShrTot}{NoShr} \quad ShrMntBlt = 97.756$

Number of Mounting Bolts in Tension : $\quad NoTen := 5$

Distance Between Mounting Bolts : (in.) $\quad LvrArm := 16.5$

Tension Load per Mounting Bolt : (lbs.) $\quad TenMntBlt := \dfrac{(ShrTot) \cdot (5.0 + 2.375)}{NoTen \cdot LvrArm} \quad TenMntBlt = 96.13$

Unity Check : $\quad UCMntBlt := \dfrac{ShrMntBlt}{AllwShr} + \dfrac{TenMntBlt}{AllwTen} \quad UCMntBlt = 0.132 \quad < \quad 1.00 \quad\quad\quad OK$
Mounting Bolts

Note :   Use 3/8" diameter 18-8 Stainless Steel bolt, with spacers thru EIFS, as listed :

        Expansion bolts in concrete or brick walls.

        Toggle bolts in concrete block or panel walls.

        TEK screws in metal studs.

        Lag bolts in wood studs.

        All thread bolts with blocking between studs.

Design of Mounting Angles for the 'amp' Letter Set :

Angle Thickness : (in.) $\quad AngleThk := 0.1875 \quad\quad\quad$ Angle Length : (in.) $\quad AngleLngth := 2.0$

Angle Specimen : (in.) $\quad PLS := (2.0 - 0.75) \quad PLS = 1.25$

Minimum Angle Thickness Required : (in.) $\quad ReqdThk := \sqrt{\left[\dfrac{ShrMntBlt \cdot PLS \cdot 6}{(AngleLngth \cdot 23760)} \right]} \quad ReqdThk = 0.124$

Unity Check - Angle Thickness : $\quad UCAngThk := \dfrac{ReqdThk}{AngleThk} \quad UCAngThk = 0.662 \quad < \quad 1.00 \quad\quad\quad OK$

Design Loads for the 'ton' Letter Set :

Dead Load :

Based on 4.5 lbs./sq.ft. : $ShrDL := (2.75 \cdot 5.75) \cdot 4.5$ $ShrDL = 71.156$ lbs.

Wind Load :

5" Deep Letter plus Mounting Angles : $ShrWL := \left[(3 \cdot 2.33) \cdot 2.75 \cdot \left(\dfrac{5.0 + 2.375}{12} \right) \right] \cdot WL$ $ShrWL = 890.763$ lbs.

Snow Load :

All Exposed Surfaces : $ShrSL := \left[5.75 \cdot 1.33 \cdot \left(\dfrac{5.0 + 2.375}{12} \right) \right] \cdot SL$ $ShrSL = 0$ lbs.

Combined Shear :

Summation : (lbs.) $ShrTot := \sqrt{\left[(ShrDL + ShrWL)^2 + (ShrWL + ShrSL)^2 \right]}$ $ShrTot = 1311.01$

Design of Mounting Bolts for the 'ton' Letter Set :

Mounting Bolt Diameter : (in.) $MntBltDia := 0.375$

Stress Area : (in.²)
(Based on nominal diameter per AISC 4-3) $MntBltArea := \dfrac{\pi \cdot MntBltDia^2}{4}$ $MntBltArea = 0.11$

Allowable Tension : (lbs.) $AllwTen := 20000 \cdot MntBltArea$ $AllwTen = 2209$

Allowable Shear : (lbs.) $AllwShr := 10000 \cdot MntBltArea$ $AllwShr = 1104$

Number of Mounting Bolts in Shear : $NoShr := 10$

Shear per Mounting Bolt : (lbs.) $ShrMntBlt := \dfrac{ShrTot}{NoShr}$ $ShrMntBlt = 131.101$

Number of Mounting Bolts in Tension : $NoTen := 5$

Minimum Distance Between Mounting Bolts : (in.) $LvrArm := 16.5$

Tension Load per Mounting Bolt : (lbs.) $TenMntBlt := \dfrac{(ShrTot) \cdot (5.0 + 2.375)}{NoTen \cdot LvrArm}$ $TenMntBlt = 117.2$

Unity Check :
Mounting Bolts $UCMntBlt := \dfrac{ShrMntBlt}{AllwShr} + \dfrac{TenMntBlt}{AllwTen}$ $UCMntBlt = 0.172$ $<$ 1.00   OK

Note :   Use 3/8" diameter 18-8 Stainless Steel bolt, with spacers thru EIFS, as listed :

Expansion bolts in concrete or brick walls.

Toggle bolts in concrete block or panel walls.

TEK screws in metal studs.

Lag bolts in wood studs.

All thread bolts with blocking between studs.

Design of Mounting Angles for the 'ton' Letter Set :

Angle Thickness : (in.) $AngleThk := 0.1875$ Angle Length : (in.) $AngleLngth := 2.0$

Angle Specimen : (in.) $PLS := (2.0 - 0.75)$ $PLS = 1.25$

Minimum Angle Thickness Required : (in.) $ReqdThk := \sqrt{\left[\dfrac{ShrMntBlt \cdot PLS \cdot 6}{(AngleLngth \cdot 23760)} \right]}$ $ReqdThk = 0.144$

Unity Check - Angle Thickness : $UCAngThk := \dfrac{ReqdThk}{AngleThk}$ $UCAngThk = 0.767$ $<$ 1.00   OK

Design Loads for the 'nn' Letter Set :

Dead Load :

Based on 4.5 lbs./sq.ft. : $ShrDL := (2.25 \cdot 4.5) \cdot 4.5$ $ShrDL = 45.563$ lbs.

Wind Load :

5" Deep Letter plus Mounting Angles : $ShrWL := \left[(2 \cdot 2.33) \cdot 2.25 \cdot \left(\dfrac{5.0 + 2.375}{12} \right) \right] \cdot WL$ $ShrWL = 485.871$ lbs.

Snow Load :

All Exposed Surfaces : $ShrSL := \left[5.75 \cdot 1.33 \cdot \left(\dfrac{5.0 + 2.375}{12} \right) \right] \cdot SL$ $ShrSL = 0$ lbs.

Combined Shear :

Summation : (lbs.) $ShrTot := \sqrt{\left[(ShrDL + ShrWL)^2 + (ShrWL + ShrSL)^2 \right]}$ $ShrTot = 720.063$

Design of Mounting Bolts for the 'nn' Letter Set :

Mounting Bolt Diameter : (in.) $MntBltDia := 0.375$

Stress Area : (in.²) $MntBltArea := \dfrac{\pi \cdot MntBltDia^2}{4}$ $MntBltArea = 0.11$
(Based on nominal diameter per AISC 4-3)

Allowable Tension : (lbs.) $AllwTen := 20000 \cdot MntBltArea$ $AllwTen = 2209$

Allowable Shear : (lbs.) $AllwShr := 10000 \cdot MntBltArea$ $AllwShr = 1104$

Number of Mounting Bolts in Shear : $NoShr := 9$

Shear per Mounting Bolt : (lbs.) $ShrMntBlt := \dfrac{ShrTot}{NoShr}$ $ShrMntBlt = 80.007$

Number of Mounting Bolts in Tension : $NoTen := 5$

Distance Between Mounting Bolts : (in.) $LvrArm := 16.5$

Tension Load per Mounting Bolt : (lbs.) $TenMntBlt := \dfrac{(ShrTot) \cdot (5.0 + 2.375)}{NoTen \cdot LvrArm}$ $TenMntBlt = 64.37$

Unity Check : $UCMntBlt := \dfrac{ShrMntBlt}{AllwShr} + \dfrac{TenMntBlt}{AllwTen}$ $UCMntBlt = 0.102$ $<$ 1.00   OK
Mounting Bolts

Note :   Use 3/8" diameter 18-8 Stainless Steel bolt, with spacers thru EIFS, as listed :

        Expansion bolts in concrete or brick walls.

        Toggle bolts in concrete block or panel walls.

        TEK screws in metal studs.

        Lag bolts in wood studs.

        All thread bolts with blocking between studs.

Design of Mounting Angles for the 'nn' Letter Set :

Angle Thickness : (in.) $AngleThk := 0.1875$ Angle Length : (in.) $AngleLngth := 2.0$

Angle Specimen : (in.) $PLS := (2.0 - 0.75)$ $PLS = 1.25$

Minimum Angle Thickness Required : (in.) $ReqdThk := \sqrt{\left[\dfrac{ShrMntBlt \cdot PLS \cdot 6}{(AngleLngth \cdot 23760)}\right]}$ $ReqdThk = 0.112$

Unity Check - Angle Thickness : $UCAngThk := \dfrac{ReqdThk}{AngleThk}$ $UCAngThk = 0.599$ <   1.00   OK

Design Loads for the 'uites' Letter Set :

Dead Load :

Based on 4.5 lbs./sq.ft. : $ShDL := (3.17 \cdot 7.58) \cdot 4.5$ $ShDL = 108.129$ lbs.

Wind Load :

5" Deep Letter plus Mounting Angles : $ShWL := \left[(5 \cdot 1.33) \cdot 3.17 \cdot \left(\dfrac{5.0 + 2.375}{12}\right)\right] \cdot WL$ $ShWL = 976.862$ lbs.

Snow Load :

All Exposed Surfaces : $ShSL := \left[1.33 \cdot 7.58 \cdot \left(\dfrac{5.0 + 2.375}{12}\right)\right] \cdot SL$ $ShSL = 0$ lbs.

Combined Shear :

Summation : (lbs.) $ShTot := \sqrt{\left[(ShDL + ShWL)^2 + (ShSL + ShWL)^2\right]}$ $ShTot = 1459.953$

Design of Mounting Bolts for the 'uites' Letter Set :

Mounting Bolt Diameter : (in.) $MntBltDia := 0.375$

Stress Area : (in.²) $MntBltArea := \dfrac{\pi \cdot MntBltDia^2}{4}$ $MntBltArea = 0.11$
(Based on nominal diameter per AISC 4-3)

Allowable Tension : (lbs.) $AllwTen := 20000 \cdot MntBltArea$ $AllwTen = 2209$

Allowable Shear : (lbs.) $AllwShr := 10000 \cdot MntBltArea$ $AllwShr = 1104$

Number of Mounting Bolts in Shear : $NoShr := 13$

Shear per Mounting Bolt : (lbs.) $ShrMntBlt := \dfrac{ShTot}{NoShr}$ $ShrMntBlt = 112.304$

Minimum Number of Mounting Bolts in Tension : $NoTen := 6$

Minimum Distance Between Mounting Bolts : (in.) $LvrArm := 11.0$

Tension Load per Mounting Bolt : (lbs.) $TenMntBlt := \dfrac{(ShTot)\cdot(5.0 + 2.375)}{NoTen \cdot LvrArm}$ $TenMntBlt = 163.14$

Unity Check :
Mounting Bolts $UCMntBlt := \dfrac{ShrMntBlt}{AllwShr} + \dfrac{TenMntBlt}{AllwTen}$ $UCMntBlt = 0.176$ $<$ 1.00   OK

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> Lag bolts in wood studs.
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> All thread bolts with blocking between studs.

> Design of Mounting Angles for the 'uites' Letter Set :

Angle Thickness : (in.) $AngleThk := 0.1875$ Angle Length : (in.) $AngleLngth := 2.0$

Angle Specimen : (in.) $PLS := (2.0 - 0.75)$ $PLS = 1.25$

Minimum Angle Thickness Required : (in.) $ReqdThk := \sqrt{\left[\dfrac{ShrMntBlt \cdot PLS \cdot 6}{(AngleLngth \cdot 23760)}\right]}$ $ReqdThk = 0.133$

Unity Check - Angle Thickness : $UCAngThk := \dfrac{ReqdThk}{AngleThk}$ $UCAngThk = 0.71$ $<$ 1.00   OK