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JOB: -

CUSTOMER: CAPITAL HARDWARE

P.O. No.:

DRAWING No.: SC-57219

STRUCTURAL CALCULATIONS ON

SLOTTED STRUT CHANNELS

TO MATCH STANDARD SMACNA

REINFORCING ANGLES

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9/10/09

OBJECTIVE

The objective of this analysis is to determine the equivalent strut that can match a standard SMACNA angle. The criteria used will be providing a strut section that is equal to or greater than the moment of inertia or section modulus of the SMACNA angle. So the main criteria are trying to match the bending properties.

CALCULATION FOR MOMENT OF INERTIA AND SECTION MODULUS OF SMACNA ANGLES

The SMACNA angles we are trying to match are as follows:

¾" x ¾" x1/8"
1"x1"x16 Gage
1"x1"x1/8"
1 ¼" x 1 ¼" x 12 Gage
1 ¼" x 1 ¼" x 1/8"
1 ½" x 1 ½" x 1/8"
1 ½" x 1 ½" x 3/16"
2" x 2"x 1/8"
2" x 2" x 3/16"
2" x 2" x ¼"
2 ½" x 2 ½" x 1/8"
2 ½" x 2 ½" x 3/16"
2 ½" x 2 ½" x ¼"
3" x 3" x ¼"

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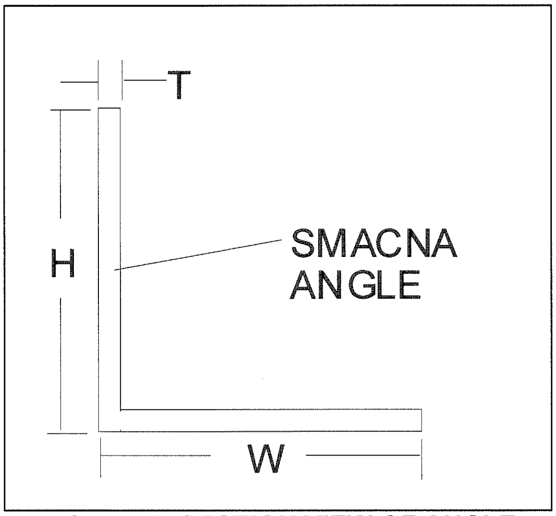

FIGURE 1: SECTION VIEW OF ANGLE

Below are the equations to determine the area, **A**, and the centroid, **Y**, of the angle.

$$A = H \times T + (H - T) \times T$$

$$Y = [\, H \times T \times H/2 + (H - T) \times T \times T/2 \,] / A$$

Below are the equations to determine the moment of inertia, **I**, and the Section Modulus, **S**, of the angle.

$$I = H^3 \times T / 12 + (H/2 - Y)^2 \times (H \times T) + (H - T) \times T^3 / 12 + (T/2 - Y)^2 \times (H - T) \times T$$

$$S = I / (H - Y)$$

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CALCULATION FOR MOMENT OF INERTIA AND SECTION MODULUS OF THE SLOTTED STRUT CHANNELS

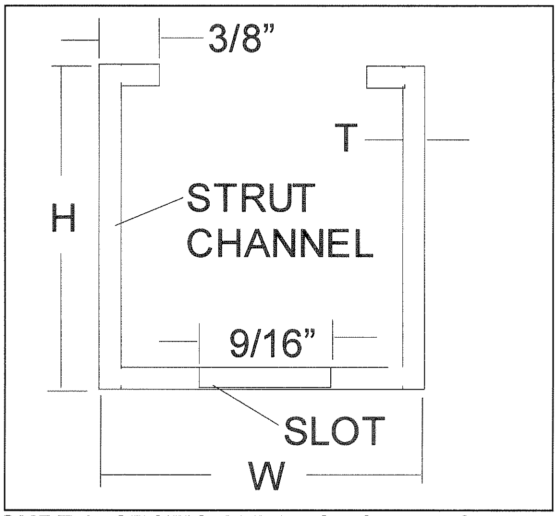

FIGURE 2: SECTION VIEW OF STRUT CHANNEL

Below are the equations to determine the area, **A**, and the centroid, **Y**, of the strut channel. The width of the Slot is 9/16".

$$A = 2 \times (H - 2 \times T) \times T + (W - \text{Slot}) \times T + 2 \times 0.375 \times T$$

$$Y = 2 \times (H - 2 \times T) \times T \times H/2 + (W - \text{Slot}) \times T \times T/2 + 2 \times 0.375 \times T \times (H - T/2) / A$$

Below are the equations to determine the moment of inertia, **I**, and the Section Modulus, **S**, of the strut channel.

$$\begin{aligned} I_{y\text{-}y} = & \left[T\times(H-2\times T)^3 /12 + (H/2 - Y)^2 \times (H-2\times T)\times T \right] \times 2 \\ & + \left[(W-\text{Slot})\times T^3 / 12 + ((W-\text{Slot})\times T) \times (Y-T/2)^2 \right] \\ & + \left[0.375\times T^3 /12 + ((H - T/2) - Y)^2 \times (0.375\times T) \right] \times 2 \end{aligned}$$

$$S_{y\text{-}y} = I_{y\text{-}y} / (H - Y)$$

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Properties of SMACNA angles and equivalent strut sizes are tabulated below.

ANGLE SIZE	AREA	I	S	WT/FT
3/4 X 3/4 X 1/8	0.172	0.009	0.017	0.58
1"x1"x16 GA	0.116	0.011	0.016	0.39
1"x1"x1/8"	0.234	0.022	0.031	0.80
1 ¼" x 1 ¼" x 12 GA	0.251	0.038	0.042	0.85
1 ¼" x 1 ¼" x 1/8"	0.297	0.044	0.049	1.01
1 ½" x 1 ½" x 1/8"	0.359	0.078	0.072	1.22
1 ½" x 1 ½" x 3/16"	0.527	0.110	0.104	1.79
2" x 2"x 1/8"	0.484	0.190	0.131	1.65
2" x 2" x 3/16"	0.715	0.272	0.190	2.43
2" x 2" x ¼"	0.938	0.348	0.247	3.19
2 ½" x 2 ½" x 1/8"	0.609	0.378	0.207	2.07
2 ½" x 2 ½" x 3/16"	0.902	0.547	0.303	3.07
2 ½" x 2 ½" x ¼"	1.188	0.703	0.394	4.04
3" x 3" x ¼"	1.438	1.244	0.577	4.89

ANGLE SIZE	EQUIVALENT STRUT SIZE	STRUT HEIGHT	GAGE	AREA	Iy-y	Sy-y	WT/FT
3/4 X 3/4 X 1/8	13/16 x 1 5/8 x 16 GA	0.8125	0.0598	0.191	0.018	0.042	0.71
1"x1"x16 GA	13/16 x 1 5/8 x 16 GA	0.8125	0.0598	0.191	0.018	0.042	0.71
1"x1"x1/8"	15/16 x 1 5/8 x 16 GA	0.9375	0.0598	0.206	0.026	0.051	0.76
1 ¼" x 1 ¼" x 12 GA	1 1/8 x 1 5/8 x 16 GA	1.125	0.0598	0.229	0.040	0.067	0.84
1 ¼" x 1 ¼" x 1/8"	1 1/4 x 1 5/8 x 16 GA	1.25	0.0598	0.244	0.052	0.078	0.89
1 ½" x 1 ½" x 1/8"	1 1/2 x 1 5/8 x 16 GA	1.5	0.0598	0.273	0.082	0.102	0.99
1 ½" x 1 ½" x 3/16"	1 3/4 x 1 5/8 x 16 GA	1.75	0.0598	0.303	0.120	0.129	1.09
2" x 2"x 1/8"	2 x 1 5/8 x 14 GA	2	0.0747	0.412	0.203	0.193	1.47
2" x 2" x 3/16"	2 1/4 x 1 5/8 x 14 GA	2.25	0.0747	0.449	0.274	0.232	1.60
2" x 2" x ¼"	2 1/4 x 1 5/8 x 12 GA	2.25	0.1046	0.617	0.365	0.308	2.20
2 ½" x 2 ½" x 1/8"	2 3/8 x 1 5/8 x 12 GA	2.375	0.1046	0.643	0.419	0.337	2.29
2 ½" x 2 ½" x 3/16"	2 3/4 x 1 5/8 x 12 GA	2.75	0.1046	0.721	0.615	0.429	2.55
2 ½" x 2 ½" x ¼"	3 x 1 5/8 x 12 GA	3	0.1046	0.773	0.774	0.495	2.73
3" x 3" x ¼"	3 5/8 x 1 5/8 x 12 GA	3.625	0.1046	0.904	1.279	0.682	3.18