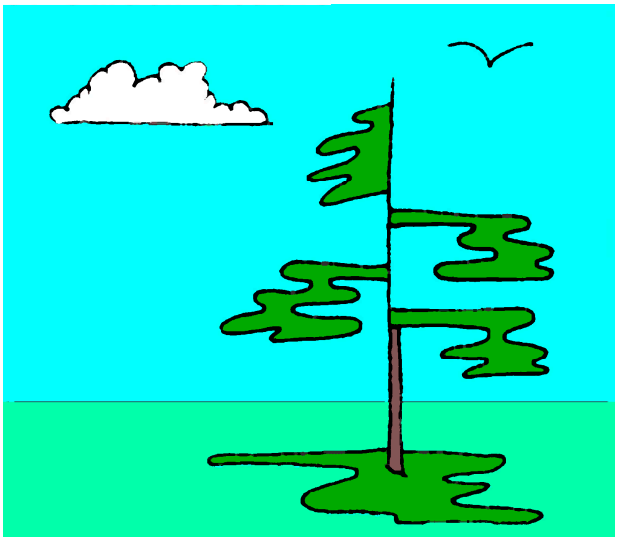
NorthWoods Software



Program Name: Weld-Design

Project Number: -

Project Description: -

Project Designer: Dik

Last Revised (yy-mm-dd): 23.11.20

Reference: NBCC, CSA S16

Disclaimer:
Created using SMath Studio, a MathCAD workalike from https://en.smath.info/view/SMathStudio. The User is responsible to verify data and calculations using an alternative method

Menu:

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Input:

Material Property Factors:

$\varphi_s := 0.90$

$\varphi_w := 0.67$

Load Factors:

$\alpha_L := 1.50$

$\alpha_D := 1.25$

Base Metal: c b a

Thickness:

$t_{b1} := 0.5\ in$	$t_{b1} = 0.50\ in$	$t_{b1} = 12.70\ mm$	Base Metal_01
$t_{b2} := 0.5\ in$	$t_{b2} = 0.50\ in$	$t_{b2} = 12.70\ mm$	Base Metal_02

Grade:

$st :=$

NDX	des	fy	Fu
1	"G40.21-350W"	350 MPa	65 Ksi
2	"G40.21-300W"	300 MPa	65 Ksi
3	"A36"	36 Ksi	58 Ksi
4	"A212 B"	38 Ksi	70 Ksi
5	"A181.1"	30 Ksi	60 Ksi

$E_s := 29000\ Ksi$ $\nu := 0.3$ $\gamma_s := 489\ pcf$

$G_s := \frac{E_s}{2 \cdot (1 + \nu)}$

Base Metal_01: $st_{NDX} := 4$ $desM_1 := st_{st_{NDX}\ 2}$ $f_{y1} := st_{st_{NDX}\ 3}$ $F_{u1} := st_{st_{NDX}\ 4}$

Base Metal_02: $st_{NDX} := 5$ $desMI_2 := st_{st_{NDX}\ 2}$ $f_{y2} := st_{st_{NDX}\ 3}$ $F_{u2} := st_{st_{NDX}\ 4}$

Welds:

Weld Length:

$l_w := 11\ in$

Electrodes: $we_{NDX} := 1$

$we :=$

NDX	DesI	DesM	UTS
1	"E60xx"	"E43xx"	60 ksi
2	"E70xx"	"E49xx"	70 ksi
3	"E80xx"	"E55xx-x"	80 ksi
4	"E90xx"	"E62xx-x"	90 ksi

$desI_w := we_{we_{NDX}\ 2}$ $desM_w := we_{we_{NDX}\ 3}$ $X_u := we_{we_{NDX}\ 4}$

Size: $ws_{NDX} := 7$

$ws :=$

NDX	desI	desM	D
1	""	"3mm"	0.11811 in
2	"1/8"	""	0.125 in
3	""	"4mm"	0.15748 in
4	"3/16"	""	0.1875 in
5	""	"5mm"	0.19685 in
6	""	"6mm"	0.23622 in
7	"1/4"	""	0.25 in
8	""	"7mm"	0.275591 in
9	"5/16"	""	0.3125 in
10	""	"8mm"	0.314961 in
11	""	"9mm"	0.354331 in
12	"3/8"	""	0.375 in
13	""	"10mm"	0.3937 in
14	""	"11mm"	0.4331 in
15	"7/16"	""	0.4375 in
16	""	"12mm"	0.4724 in
17	"1/2"	""	0.50 in

$desI_D := ws_{ws_{NDX},2}$ $desM_D := ws_{ws_{NDX},3}$ $D := ws_{ws_{NDX},4}$

Minimum Weld Size:

$t_w := \max([\, t_{b1} \;\; t_{b2} \,])$ $t_w = 0.500$ in $t_w = 12.7$ mm Maximum Plate Thickness

Plate Thickness Override:

$t'_w := 0$ in $t'_w = 0.000$ in $t'_w = 0.0$ mm Plate Thickness Override

```
if t'_w = 0 in
    t_w := t_w
else
    t_w := t'_w
```

$t_w = 0.500$ in $t_w = 12.7$ mm Design Plate Thickness

```
if t_w ≤ 6 mm
    D_min := 3 mm
else
    if t_w ≤ 12 mm
        D_min := 5 mm
    else
        if t_w ≤ 20 mm
            D_min := 6 mm
        else
            D_min := 8 mm
```

c b a

$D_{min} = 0.2362$ in $D_{min} = 6.00$ mm Minimum Size Fillet Weld

Weld Resistance:

$v_{rw} := \varphi_w \cdot 0.67 \cdot \frac{X_u}{\sqrt{2}}$ $v_{rw} = 19.05$ ksi $v_{rw} = 131.31$ MPa Weld Strength

$v_{rb1} := \varphi_w \cdot 0.67 \cdot F_{u1}$ $v_{rb1} = 31.42$ Ksi $v_{rb1} = 216.65$ MPa Base Metal_1 Strength

$v_{rb2} := \varphi_w \cdot 0.67 \cdot F_{u2}$ $v_{rb2} = 26.93$ Ksi $v_{rb2} = 185.70$ MPa Base Metal_2 Strength

$V_{rw} := \min([\, v_{rw} \;\; v_{rb1} \;\; v_{rb2} \,])$ Minimum Weld Resistance

$V_{rw} = 19.05$ Ksi $V_{rw} = 131.31$ MPa

Summary:

Material Property Factors

$\varphi_s = 0.90$ Rolled Steel

$\varphi_w = 0.67$ Weld

Load Factors

$\alpha_L = 1.50$

$\alpha_D = 1.25$

Material Properties

Base Metal_01

Designation	$desM_1 = \text{"A212 B"}$	
Yield Strength	$f_{y1} = 38\ Ksi$	$f_{y1} = 262\ MPa$
Ultimate Strength	$F_{u1} = 70\ Ksi$	$F_{u1} = 483\ MPa$
Thickness:	$t_{b1} = 0.50\ in$	$t_{b1} = 12.70\ mm$

Base Metal_02

Designation	$desMI_2 = \text{"A181.1"}$	
Yield Strength	$f_{y2} = 30\ Ksi$	$f_{y2} = 207\ MPa$
Ultimate Strength	$F_{u2} = 60\ Ksi$	$F_{u2} = 414\ MPa$
Thickness:	$t_{b2} = 0.50\ in$	$t_{b2} = 12.70\ mm$
Young's Modulus	$E_s = 29000\ Ksi$	$E_s = 2 \cdot 10^5\ MPa$
Shear Modulus	$G_s = 11154\ Ksi$	$G_s = 76903\ MPa$
Poisson's Ratio	$\nu := 0.3$	
Density	$\gamma_s := 489\ pcf$	

Weld Data

Electrode	$desI_w = \text{"E60xx"}$	$desM_w = \text{"E43xx"}$
Electrode Ultimate Strength	$X_u = 60\ Ksi$	$X_u = 413.6854\ MPa$
Fillet Weld Specified Size	$desI_D = \text{"1/4"}$	$desM_D = \text{""}$
Fillet Weld Dimension	$D = 0.25\ in$	$D = 6.35\ mm$
Maximum Plate Thickness	$t_w = 0.50\ in$	$t_w = 12.70\ mm$
Plate Thickness Override	$t'_w = 0.00\ in$	$t'_w = 0.00\ mm$
Design Plate Thickness	$t'_w = 0.000\ in$	$t'_w = 0.0\ mm$
Minimum Size Fillet Weld	$D_{min} = 0.2362\ in$	$D_{min} = 6.00\ mm$
Weld Strength	$v_{rw} = 19.05\ ksi$	$v_{rw} = 131.31\ MPa$
Base Metal_1 Strength	$v_{rb1} = 31.42\ Ksi$	$v_{rb1} = 216.65\ MPa$
Base Metal_2 Strength	$v_{rb2} = 26.93\ Ksi$	$v_{rb2} = 185.70\ MPa$
Minimum Weld Resistance	$V_{rw} = 19.05\ Ksi$	$V_{rw} = 131.31\ MPa$

c b a