



Design Conditions:

Code: **ASME B31.3**

Year: **2018**

Addenda: -

MAWP Internal: **50** psi

MAWP External: **0** psi

Max. Temperature: **300** °F

MDMT: **50** °F

MDMT Pressure: **50** psi

Corrosion Allowance: **0** in

Hydrostatic Test: **75** psi

Impact Testing: **None**

Impact Exemption: **323.2.2**

Radiography: **5%**

Conclusion:

The Steam Fitting has been analyzed to ASME B31.3, 2018 edition rules and is found acceptable.

ASME B31.3 Piping Calculations

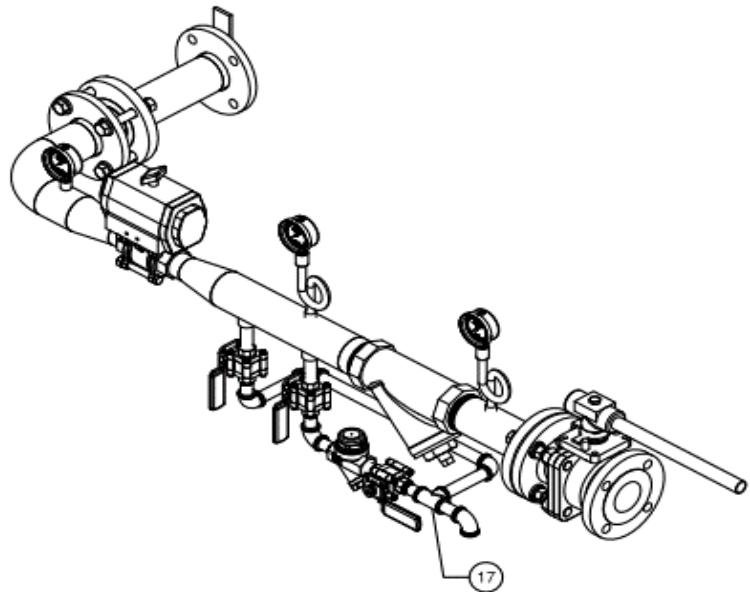
Cust: **Caloris Engineering LLC**

File: **15912c-1 R0**

Desc: **Steam Fitting**

Dwg: **M877-8469**

Date: **August 17, 2020**



Author: **Farid Sarihi, EIT**

Reviewer: **Jakub Luszczki, C.E.T.**

Notes:

301 Loads Considered:

- (301.2) Design Pressure: **Yes**
 (301.3) Design Temperature: **Yes**
 (301.4) Ambient Effects: **No**
 (301.5) Dynamic Effects: **No**
 (301.6) Weight Effects: **No**
 (301.7) Thermal Expansion Effects: **No**
 (301.8) Support Effects: **No**
 (301.9) Reduced Ductility Effects: **No**
 (301.10) Cyclic Effects: **No**
 (301.11) Air Condensation Effects: **No**

Revisions:

[illegible]

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Steam Fitting Vessel

Design Pressure:

50 P [psi] - design pressure
0 mpa [psi] - external operation pressure

Hydro Test: ASME B31.3 345.4.2

Test Pressure = 1.5*mDp*MR-sH = 1.5 * 50 * 1 - 0 mTp = 75

Material Properties: ASME B31.3 Table A-1

300 Temp [°F] - design temperature

Material	Application	Ambient Strength	Design Strength	Strength Ratio	Min °F	Max °F	Index
A182 F304 Forging & Fitting - S30400 []		20000	20000	1	-425	1500	1
A312 TP304 Pipe - S30400 []		20000	20000	1	-425	1500	2
A403 WP304 Forging & Fitting - S30400 []		20000	20000	1	-425	1500	3
							4
							5
							6
							7
							8
							9
							10
							11
							12
							13

Min Ratio (MR) = 1.000

Item1, 3 - Flange Description

Flange Inputs:

	SA 182 Gr. F304	Material
150	Class	- pressure class
50.0	P [psi]	- design pressure
300	Temp [°F]	- design temperature

Geometry Constraints and Data:

Comp	= Vlookup(Material,FlangeMatChart,3)	composition	18Cr-8Ni
Table	= Vlookup(Material,FlangeMatChart,2)	pressure table	Table221
TM [°F]	= Vlookup(Material,FlangeMatChart,5)	max temperature	1500
TM	>=Temp		1500>=300 Acceptable

Pressure Rating:

Pclass [psi]	= PVELookup(Table,"Int1Dlin",Class,Temp)	rated pressure	205
Pclass	>=P		205>=50 Acceptable

Weld Inputs:

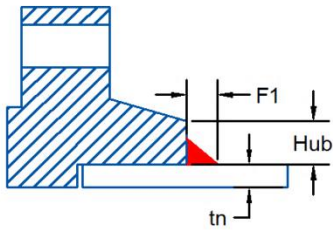
2.5	Size	- nominal flange size	
0.120	tn [in]	- nominal pipe wall thickness	
0.000	Corr [in]	- internal corrosion allowance	
Hub [in]	= PVELOOKUP("B16.5_Class"&Class,"Lookup", "HubSO",Size)		0.310

Socket Weld: VIII-1 Fig UW-21, B31.1 Fig 127.4.4(B), B31.3 Fig 328.5.2B

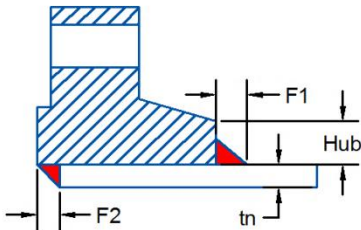
F1sw [in]	= Min(1.4*tn,Hub)	minimum outer fillet	MIN(1.4*0.12,0.31) = 0.168
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Slip On Weld: VIII-1 Fig UW-21, B31.1 Fig 127.4.4(B), B31.3 Fig 328.5.2B

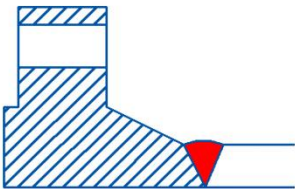
F1so [in]	= Min(1.4*tn,Hub)	minimum outer fillet	MIN(1.4*0.12,0.31) = 0.168
F2so [in]	= Min(tn,0.25+Corr/0.7)	minimum inner fillet	MIN(0.12,0.25+0/0.7) = 0.120



Socket Weld



Slip On Weld



Weld Neck Weld

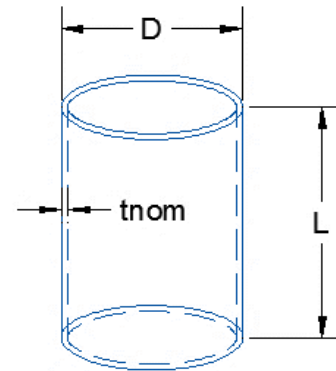
2.5" Pipe - Item 2 Description

Dimensions:

2.875	D _[in] - outside diameter
0.120	tnom _[in] - nominal thickness
0.000	h _[in] - thread allowance B1.20.2
12.500%	UT _[%] - undertolerance allowance
0.000	Ca _[in] - corrosion allowance
0.000	Ma _[in] - mechanical allowance

Material and Conditions:

300	Temp _[°F] - design temperature
A312 TP304	Pipe - S30400 [] Material
20,000	S _[psi] - allowable stress level
1.00	E - longitudinal efficiency (circ. stress)
1.00	W - weld joint reduction factor
50.0	P _[psi] - design pressure



Variables:

ci _[in] = Ma+Ca	0+0 = 0.0000
co _[in] = h	0 = 0.0000
c _[in] = ci+co	0+0 = 0.0000
T _[in] = tnom*(1-UT)	0.12*(1-0.125) = 0.1050
d _[in] = D-2*T	2.875-2*0.105 = 2.6650
Y1 = From Table 304.1.1	= 0.40
Y2 = (d+2*c)/(D+d+2*c)	(2.665+2*0)/(2.875+2.665+2*0) = 0.4810

Interior Pressure: B31.3-304.1.2

t1 _[in] = P*D/(2*(S*E*W+P*Y1))	50*2.875/(2*(20000*1*1+50*0.4)) = 0.0036
t2 _[in] = P*D/(2*(S*E*W+P*Y2))	50*2.875/(2*(20000*1*1+50*0.481)) = 0.0036
t _[in] = if(t1>=D/6,t2,t1)	IF(0.0036>=2.875/6,0.0036,0.0036) = 0.0036
SR _[] = if(t1>=D/6,S2/S,S1/S)	IF(0.0036>=2.875/6,660/20000,665/20000) = 0.033
tm _[in] = t+c	0.0036+0 = 0.0036
T >= tm	0.105 >= 0.0036 Acceptable

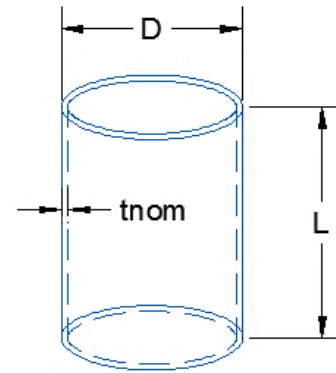
2.5" Fittings - Items 4, 5 Description

Dimensions:

2.875	D _[in] - outside diameter
0.120	tnom _[in] - nominal thickness
0.000	h _[in] - thread allowance B1.20.2
12.500%	UT _[%] - undertolerance allowance
0.000	Ca _[in] - corrosion allowance
0.000	Ma _[in] - mechanical allowance

Material and Conditions:

300	Temp _[°F] - design temperature
A403 WP304 Forging & Fitting - S30400	Material
20,000	S _[psi] - allowable stress level
1.00	E - longitudinal efficiency (circ. stress)
1.00	W - weld joint reduction factor
50.0	P _[psi] - design pressure



Variables:

ci _[in] = Ma+Ca	0+0 = 0.0000
co _[in] = h	0 = 0.0000
c _[in] = ci+co	0+0 = 0.0000
T _[in] = tnom*(1-UT)	0.12*(1-0.125) = 0.1050
d _[in] = D-2*T	2.875-2*0.105 = 2.6650
Y1 = From Table 304.1.1	= 0.40
Y2 = (d+2*c)/(D+d+2*c)	(2.665+2*0)/(2.875+2.665+2*0) = 0.4810

Interior Pressure: B31.3-304.1.2

t1 _[in] = P*D/(2*(S*E*W+P*Y1))	50*2.875/(2*(20000*1*1+50*0.4)) = 0.0036
t2 _[in] = P*D/(2*(S*E*W+P*Y2))	50*2.875/(2*(20000*1*1+50*0.481)) = 0.0036
t _[in] = if(t1>=D/6,t2,t1)	IF(0.0036>=2.875/6,0.0036,0.0036) = 0.0036
SR _[-] = if(t1>=D/6,S2/S,S1/S)	IF(0.0036>=2.875/6,660/20000,665/20000) = 0.033
tm _[in] = t+c	0.0036+0 = 0.0036
T >= tm	0.105 >= 0.0036 Acceptable

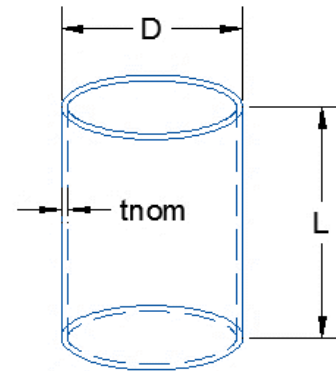
1.5" Pipe - Item 6 Description

Dimensions:

1.900	D _[in] - outside diameter
0.109	tnom _[in] - nominal thickness
0.000	h _[in] - thread allowance B1.20.2
12.500%	UT _[%] - undertolerance allowance
0.000	Ca _[in] - corrosion allowance
0.000	Ma _[in] - mechanical allowance

Material and Conditions:

300	Temp _[°F] - design temperature
A312 TP304	Pipe - S30400 [] Material
20,000	S _[psi] - allowable stress level
1.00	E - longitudinal efficiency (circ. stress)
1.00	W - weld joint reduction factor
50.0	P _[psi] - design pressure



Variables:

ci _[in] = Ma+Ca	0+0 = 0.0000
co _[in] = h	0 = 0.0000
c _[in] = ci+co	0+0 = 0.0000
T _[in] = tnom*(1-UT)	0.109*(1-0.125) = 0.0954
d _[in] = D-2*T	1.9-2*0.0954 = 1.7093
Y1 = From Table 304.1.1	= 0.40
Y2 = (d+2*c)/(D+d+2*c)	(1.7093+2*0)/(1.9+1.7093+2*0) = 0.4736

Interior Pressure: B31.3-304.1.2

t1 _[in] = P*D/(2*(S*E*W+P*Y1))	50*1.9/(2*(20000*1*1+50*0.4)) = 0.0024
t2 _[in] = P*D/(2*(S*E*W+P*Y2))	50*1.9/(2*(20000*1*1+50*0.4736)) = 0.0024
t _[in] = if(t1>=D/6,t2,t1)	IF(0.0024>=1.9/6,0.0024,0.0024) = 0.0024
SR _[] = if(t1>=D/6,S2/S,S1/S)	IF(0.0024>=1.9/6,474/20000,478/20000) = 0.024
tm _[in] = t+c	0.0024+0 = 0.0024
T >= tm	0.0954 >= 0.0024 Acceptable

Item 7 - Branch on item 2		Description
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B31.3	Code? - select
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a	Nozzle_Design? - select
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Conditions:

300	Temp [°F] - design temperature
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50.0	P [psi] - Pressure
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Header/Run:

A312 TP304	Pipe - S30400 []	Material-Header
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AusteniticSteel	GroupH - material group
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20,000	Sh [psi] - allowable stress
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1.00	Eh - longitudinal efficiency
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1.00	Wh
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12.50%	UTh [%] - undertolerance allowance
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0.0000	ch [in] - corrosion or mechanical allowance, B31.3
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2.8750	Dh [in] - outside diameter, B31.3
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0.1200	tnh [in] - nominal thickness
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Branch:

A182 F304 Forging & Fitting - S30400 []	Material-Branch
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AusteniticSteel	GroupB - material group
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20,000	Sb [psi] - allowable branch stress
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1.00	Eb - longitudinal efficiency
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1.00	Wb
------	----

0.00%	UTb [%] - undertolerance allowance
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0.0000	cb [in] - corrosion or mechanical allowance, B31.3
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1.3800	Db [in] - branch outside diameter, B31.3
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0.1050	tnb [in] - nominal thickness
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0.1250	Leg41 [in] - branch fillet weld size
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90	β [°] - angle between header and branch, B31.3
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Weld Size Checks:

$$\text{Throat}_{41} [\text{in}] = 0.7 * \text{Leg}_{41}$$

$$t_c [\text{in}] = \text{Min}(0.25, 0.7 * t_{nb})$$

$$\text{Throat}_{41} \geq t_c$$

$$\beta \geq 45$$

$$0.7 * 0.125 = 0.0875$$

$$\text{Min}(0.25, 0.7 * 0.105) = 0.0735$$

$$0.0875 \geq 0.0735 \quad \text{Acceptable}$$

$$90 \geq 45 \quad \text{Acceptable}$$

Header Interior Pressure Rating: 304.1.2 for B31.3

$$T_h [\text{in}] = t_{nh} * (1 - U_{Th}) \quad \text{available thickness}$$

$$t_h [\text{in}] = P * D_h / (2 * (S_h * E_h * W_h + P * Y_h))$$

$$T_h \geq t_h + c_h$$

$$0.12 * (1 - 0.125) = 0.1050$$

$$50 * 2.875 / (2 * (20000 * 1 * 1 + 50 * 0.4)) = 0.0036$$

$$0.105 \geq 0.0036 + 0 \quad \text{Acceptable}$$

Branch Interior Pressure Rating: 304.1.2 for B31.3

$$T_b [\text{in}] = t_{nb} * (1 - U_{Tb}) \quad \text{available thickness}$$

$$t_b [\text{in}] = P * D_b / (2 * (S_b * E_b * W_b + P * Y_b))$$

$$T_b \geq t_b + c_b$$

$$0.105 * (1 - 0) = 0.1050$$

$$50 * 1.38 / (2 * (20000 * 1 * 1 + 50 * 0.4)) = 0.0017$$

$$0.105 \geq 0.0017 + 0 \quad \text{Acceptable}$$

Dimensions:

$$d_1 [\text{in}] = (D_b - 2 * (T_b - c_b)) / \sin(\text{radians}(\beta)) \quad \text{run direction hole size in branch, B31.3}$$

$$(1.38 - 2 * (0.105 - 0)) / \sin(\text{RADIANS}(90)) = 1.1700$$

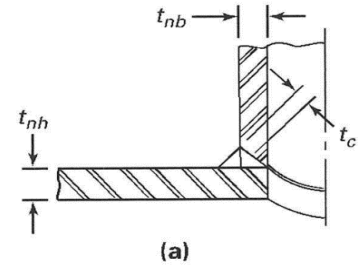
$$d_2 [\text{in}] = (T_b - c_b) + (T_h - c_h) + d_1 / 2 \quad \text{"Half Width" of reinforcement zone, B31.3}$$

$$(0.105 - 0) + (0.105 - 0) + 1.17 / 2 = 0.7950$$

$$d_{2\text{Use}} [\text{in}] = \text{Min}(D_h, \text{Max}(d_1, d_2)) \quad \text{"Half Width" of reinforcement zone, B31.3}$$

$$\text{Min}(2.875, \text{Max}(1.17, 0.795)) = 1.1700$$

$$L_4 [\text{in}] = \text{Min}(2.5 * (T_b - c_b), 2.5 * (T_h - c_h)) \quad \text{branch reinforcement length limit}$$

$$\text{Min}(2.5 * (0.105 - 0), 2.5 * (0.105 - 0)) = 0.2625$$


1 **Available Material Inside Code Limits:** This material is allowed to be used

2 $\text{Leg41i}_{[in]} = \text{if}(L4 \geq \text{Leg41}, \text{Leg41}, L4)$ Leg41 if inside limits $\text{IF}(0.2625 \geq 0.125, 0.125, 0.2625) = 0.1250$

3 **Area Replacement:** 304.3.3 for B31.3

4 $A1_{[in2]} = \text{th} * d1 * (2 - \sin(\text{radians}(\beta)))$ required area $0.0036 * 1.17 * (2 - \sin(\text{RADIANS}(90))) = 0.0042$

5

6 $A2_{[in2]} = (2 * d2_{\text{Use}} - d1) * (\text{Th} - \text{th} - \text{ch})$ pipe $(2 * 1.17 - 1.17) * (0.105 - 0.0036 - 0) = 0.1186$

7

8 $A3_{[in2]} = 2 * L4 * (\text{Tb} - \text{tb} - \text{cb}) / \sin(\text{radians}(\beta)) * \min(\text{Sb} / \text{Sh}, 1)$ branch $2 * 0.2625 * (0.105 - 0.0017 - 0) / \sin(\text{RADIANS}(90)) * \min(20000 / 20000, 1) = 0.0542$

9

10 $A41_{[in2]} = (\text{Leg41i}^2) * \min(\text{Sb} / \text{Sh}, 1)$ weld 41, part of A4 $(0.125^2) * \min(20000 / 20000, 1) = 0.0156$

11

12 **Available** $_{[in2]} = A2 + A3 + A41$ $0.1186 + 0.0542 + 0.0156 = 0.1885$

13 **Available** $\geq A1$ $0.1885 \geq 0.0042$ **Acceptable**

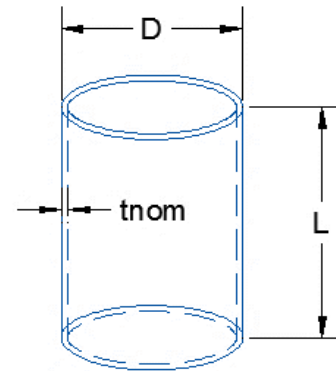
2.5" Pipe - Items 10, 11 Description

Dimensions:

2.875	D _[in] - outside diameter
0.203	tnom _[in] - nominal thickness
0.100	h _[in] - thread allowance B1.20.2
12.500%	UT _[%] - undertolerance allowance
0.000	Ca _[in] - corrosion allowance
0.000	Ma _[in] - mechanical allowance

Material and Conditions:

300	Temp _[°F] - design temperature
A312 TP304	Pipe - S30400 [] Material
20,000	S _[psi] - allowable stress level
1.00	E - longitudinal efficiency (circ. stress)
1.00	W - weld joint reduction factor
50.0	P _[psi] - design pressure



Variables:

ci _[in] = Ma+Ca	0+0 = 0.0000
co _[in] = h	0.1 = 0.1000
c _[in] = ci+co	0+0.1 = 0.1000
T _[in] = tnom*(1-UT)	0.203*(1-0.125) = 0.1776
d _[in] = D-2*T	2.875-2*0.1776 = 2.5198
Y1 = From Table 304.1.1	= 0.40
Y2 = (d+2*c)/(D+d+2*c)	(2.5198+2*0.1)/(2.875+2.5198+2*0.1) = 0.4861

Interior Pressure: B31.3-304.1.2

t1 _[in] = P*D/(2*(S*E*W+P*Y1))	50*2.875/(2*(20000*1*1+50*0.4)) = 0.0036
t2 _[in] = P*D/(2*(S*E*W+P*Y2))	50*2.875/(2*(20000*1*1+50*0.4861)) = 0.0036
t _[in] = if(t1>=D/6,t2,t1)	IF(0.0036>=2.875/6,0.0036,0.0036) = 0.0036
SR _[] = if(t1>=D/6,S2/S,S1/S)	IF(0.0036>=2.875/6,902/20000,906/20000) = 0.045
tm _[in] = t+c	0.0036+0.1 = 0.1036
T >= tm	0.1776 >= 0.1036 Acceptable

Item 12 - Branch on item 2		Description
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B31.3	Code? - select
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a	Nozzle_Design? - select
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Conditions:

300	Temp [°F] - design temperature
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50.0	P [psi] - Pressure
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Header/Run:

A312 TP304	Pipe - S30400 []	Material-Header
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AusteniticSteel	GroupH - material group
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20,000	Sh [psi] - allowable stress
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1.00	Eh - longitudinal efficiency
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1.00	Wh
------	----

12.50%	UTh [%] - undertolerance allowance
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0.0000	ch [in] - corrosion or mechanical allowance, B31.3
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2.8750	Dh [in] - outside diameter, B31.3
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0.1200	tnh [in] - nominal thickness
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Branch:

A182 F304 Forging & Fitting - S30400 []	Material-Branch
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AusteniticSteel	GroupB - material group
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20,000	Sb [psi] - allowable branch stress
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1.00	Eb - longitudinal efficiency
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1.00	Wb
------	----

0.00%	UTb [%] - undertolerance allowance
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0.0000	cb [in] - corrosion or mechanical allowance, B31.3
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1.8800	Db [in] - branch outside diameter, B31.3
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0.1400	tnb [in] - nominal thickness
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0.1400	Leg41 [in] - branch fillet weld size
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90	β [°] - angle between header and branch, B31.3
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Weld Size Checks:

$$\text{Throat}_{41} [\text{in}] = 0.7 * \text{Leg}_{41}$$

$$t_c [\text{in}] = \text{Min}(0.25, 0.7 * t_{nb})$$

$$\text{Throat}_{41} \geq t_c$$

$$\beta \geq 45$$

$$0.7 * 0.14 = 0.0980$$

$$\text{Min}(0.25, 0.7 * 0.14) = 0.0980$$

$$0.098 \geq 0.098 \quad \text{Acceptable}$$

$$90 \geq 45 \quad \text{Acceptable}$$

Header Interior Pressure Rating: 304.1.2 for B31.3

$$T_h [\text{in}] = t_{nh} * (1 - U_{Th}) \quad \text{available thickness}$$

$$t_h [\text{in}] = P * D_h / (2 * (S_h * E_h * W_h + P * Y_h))$$

$$T_h \geq t_h + c_h$$

$$0.12 * (1 - 0.125) = 0.1050$$

$$50 * 2.875 / (2 * (20000 * 1 * 1 + 50 * 0.4)) = 0.0036$$

$$0.105 \geq 0.0036 + 0 \quad \text{Acceptable}$$

Branch Interior Pressure Rating: 304.1.2 for B31.3

$$T_b [\text{in}] = t_{nb} * (1 - U_{Tb}) \quad \text{available thickness}$$

$$t_b [\text{in}] = P * D_b / (2 * (S_b * E_b * W_b + P * Y_b))$$

$$T_b \geq t_b + c_b$$

$$0.14 * (1 - 0) = 0.1400$$

$$50 * 1.88 / (2 * (20000 * 1 * 1 + 50 * 0.4)) = 0.0023$$

$$0.14 \geq 0.0023 + 0 \quad \text{Acceptable}$$

Dimensions:

$$d_1 [\text{in}] = (D_b - 2 * (T_b - c_b)) / \sin(\text{radians}(\beta)) \quad \text{run direction hole size in branch, B31.3}$$

$$(1.88 - 2 * (0.14 - 0)) / \sin(\text{RADIANS}(90)) = 1.6000$$

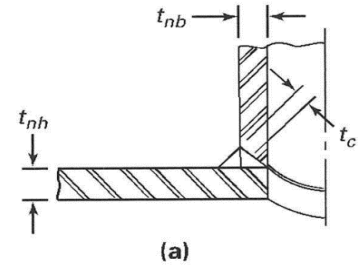
$$d_2 [\text{in}] = (T_b - c_b) + (T_h - c_h) + d_1 / 2 \quad \text{"Half Width" of reinforcement zone, B31.3}$$

$$(0.14 - 0) + (0.105 - 0) + 1.6 / 2 = 1.0450$$

$$d_{2\text{Use}} [\text{in}] = \text{Min}(D_h, \text{Max}(d_1, d_2)) \quad \text{"Half Width" of reinforcement zone, B31.3}$$

$$\text{Min}(2.875, \text{Max}(1.6, 1.045)) = 1.6000$$

$$L_4 [\text{in}] = \text{Min}(2.5 * (T_b - c_b), 2.5 * (T_h - c_h)) \quad \text{branch reinforcement length limit}$$

$$\text{Min}(2.5 * (0.14 - 0), 2.5 * (0.105 - 0)) = 0.2625$$


1 **Available Material Inside Code Limits:** This material is allowed to be used
2 $\text{Leg41i}_{[in]} = \text{if}(L4 \geq \text{Leg41}, \text{Leg41}, L4)$ Leg41 if inside limits $\text{IF}(0.2625 \geq 0.14, 0.14, 0.2625) = 0.1400$

3 **Area Replacement:** 304.3.3 for B31.3
4 $A1_{[in2]} = \text{th} * d1 * (2 - \sin(\text{radians}(\beta)))$ required area $0.0036 * 1.6 * (2 - \sin(\text{RADIANS}(90))) = 0.0057$
5
6 $A2_{[in2]} = (2 * d2_{\text{Use}} - d1) * (\text{Th} - \text{th} - \text{ch})$ pipe $(2 * 1.6 - 1.6) * (0.105 - 0.0036 - 0) = 0.1623$
7
8 $A3_{[in2]} = 2 * L4 * (\text{Tb} - \text{tb} - \text{cb}) / \sin(\text{radians}(\beta)) * \min(\text{Sb} / \text{Sh}, 1)$ branch $(2 * 1.6 - 1.6) * (0.105 - 0.0036 - 0) = 0.1623$
9 $2 * 0.2625 * (0.14 - 0.0023 - 0) / \sin(\text{RADIANS}(90)) * \min(20000 / 20000, 1) = 0.0723$
10 $A41_{[in2]} = (\text{Leg41i}^2) * \min(\text{Sb} / \text{Sh}, 1)$ weld 41, part of A4 $(0.14^2) * \min(20000 / 20000, 1) = 0.0196$
11
12 **Available** $_{[in2]} = A2 + A3 + A41$ $0.1623 + 0.0723 + 0.0196 = 0.2541$
13 **Available** $\geq A1$ $0.2541 \geq 0.0057$ **Acceptable**

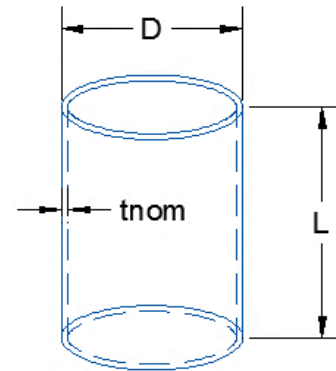
0.5" Pipe - Items 13,14,15,18 Description

Dimensions:

0.840	D _[in] - outside diameter
0.109	tnom _[in] - nominal thickness
0.057	h _[in] - thread allowance B1.20.2
12.500%	UT _[%] - undertolerance allowance
0.000	Ca _[in] - corrosion allowance
0.000	Ma _[in] - mechanical allowance

Material and Conditions:

300	Temp _[°F] - design temperature
A312 TP304	Pipe - S30400 [] Material
20,000	S _[psi] - allowable stress level
1.00	E - longitudinal efficiency (circ. stress)
1.00	W - weld joint reduction factor
50.0	P _[psi] - design pressure



Variables:

ci _[in] = Ma+Ca	0+0 = 0.0000
co _[in] = h	0.057 = 0.0571
c _[in] = ci+co	0+0.0571 = 0.0571
T _[in] = tnom*(1-UT)	0.109*(1-0.125) = 0.0954
d _[in] = D-2*T	0.84-2*0.0954 = 0.6493
Y1 = From Table 304.1.1	= 0.40
Y2 = (d+2*c)/(D+d+2*c)	(0.6493+2*0.0571)/(0.84+0.6493+2*0.0571) = 0.4762

Interior Pressure: B31.3-304.1.2

t1 _[in] = P*D/(2*(S*E*W+P*Y1))	50*0.84/(2*(20000*1*1+50*0.4)) = 0.0010
t2 _[in] = P*D/(2*(S*E*W+P*Y2))	50*0.84/(2*(20000*1*1+50*0.4762)) = 0.0010
t _[in] = if(t1>=D/6,t2,t1)	IF(0.001>=0.84/6,0.001,0.001) = 0.0010
SR _[] = if(t1>=D/6,S2/S,S1/S)	IF(0.001>=0.84/6,525/20000,529/20000) = 0.026
tm _[in] = t+c	0.001+0.0571 = 0.0582
T >= tm	0.0954 >= 0.0582 Acceptable

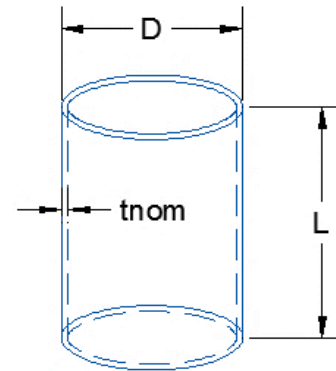
0.5" Fittings - Items 16, 17 Description

Dimensions:

0.840	D _[in] - outside diameter
0.147	tnom _[in] - nominal thickness
0.000	h _[in] - thread allowance B1.20.2
0.000%	UT _[%] - undertolerance allowance
0.000	Ca _[in] - corrosion allowance
0.000	Ma _[in] - mechanical allowance

Material and Conditions:

300	Temp _[°F] - design temperature
A403 WP304 Forging & Fitting - S30400	Material
20,000	S _[psi] - allowable stress level
1.00	E - longitudinal efficiency (circ. stress)
1.00	W - weld joint reduction factor
50.0	P _[psi] - design pressure



Variables:

ci _[in] = Ma+Ca	0+0 = 0.0000
co _[in] = h	0 = 0.0000
c _[in] = ci+co	0+0 = 0.0000
T _[in] = tnom*(1-UT)	0.147*(1-0) = 0.1470
d _[in] = D-2*T	0.84-2*0.147 = 0.5460
Y1 = From Table 304.1.1	= 0.40
Y2 = (d+2*c)/(D+d+2*c)	(0.546+2*0)/(0.84+0.546+2*0) = 0.3939

Interior Pressure: B31.3-304.1.2

t1 _[in] = P*D/(2*(S*E*W+P*Y1))	50*0.84/(2*(20000*1*1+50*0.4)) = 0.0010
t2 _[in] = P*D/(2*(S*E*W+P*Y2))	50*0.84/(2*(20000*1*1+50*0.3939)) = 0.0010
t _[in] = if(t1>=D/6,t2,t1)	IF(0.001>=0.84/6,0.001,0.001) = 0.0010
SR _[-] = if(t1>=D/6,S2/S,S1/S)	IF(0.001>=0.84/6,123/20000,123/20000) = 0.006
tm _[in] = t+c	0.001+0 = 0.0010
T >= tm	0.147 >= 0.001 Acceptable

Fig. 328.5.2C

Item Description	Socket Wall	T_w	Weld Size	$1.09T_w$	Min. Weld	Check
Item 16 - Elbow	0.184	0.109	0.188	0.119	0.119	Acceptable
Item 17 - Tee	0.184	0.109	0.188	0.119	0.119	Acceptable

Fig. 328.5.2C Minimum Welding Dimensions for Socket Welding Components Other Than Flanges

