

Nozzle Schedule

Specifications									
Nozzle mark	Identifier	Size	Materials		Impact Tested	Normalized	Fine Grain	Flange	Blind
N1	Nozzle #1	NPS 1.5 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 1 1/2 Class 150 SO A182 F316	No
N11	Nozzle #10	NPS 0.75 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 3/4 Class 150 SO A182 F316	No
N12	Nozzle #11	NPS 2 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 2 Class 150 SO A182 F316	No
N13	Nozzle #12	NPS 2 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 2 Class 150 SO A182 F316	No
N2	Nozzle #2	NPS 0.5 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 1/2 Class 150 SO A182 F316	No
N3	Nozzle #3	NPS 1.5 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 1 1/2 Class 150 SO A182 F316	No
N4	Nozzle #4	NPS 1.5 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 1 1/2 Class 150 SO A182 F316	No
N5	Nozzle #5	NPS 1.5 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 1 1/2 Class 150 SO A182 F316	No
N6	Nozzle #6	NPS 1 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 1 Class 150 SO A182 F316	No
N7	Nozzle #7	NPS 0.75 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 3/4 Class 150 SO A182 F316	No
N8	Nozzle #8	NPS 2 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 2 Class 150 SO A182 F316	No
N9	Nozzle #9	NPS 2 Sch 40S (Std)	Nozzle	SA-312 TP316 Wld pipe	No	No	No	NPS 2 Class 150 SO A182 F316	No

Thickness Summary

Component Data								
Component Identifier	Material	Diameter (in)	Length (in)	Nominal t (in)	Design t (in)	Total Corrosion (in)	Joint E	Load
<u>TOP DISH</u>	SA-240 316	54 ID	9.2873	0.125*	0.0362	0	0.70	Internal
Straight Flange on TOP DISH	SA-240 316	54 ID	2	0.25	0.0207	0	0.70	Internal
<u>SHELL 2</u>	SA-240 316	54 ID	14	0.1875	0.0218	0	0.70	Internal
<u>SHELL 1</u>	SA-240 316	54 ID	48	0.1875	0.0256	0	0.70	Internal
Straight Flange on BOTTOM DISH	SA-240 316	54 ID	2	0.25	0.0257	0	0.70	Internal
<u>BOTTOM DISH</u>	SA-240 316	54 ID	9.2873	0.125*	0.0467	0	0.70	Internal

*Head minimum thickness after forming

Definitions	
Nominal t	Vessel wall nominal thickness
Design t	Required vessel thickness due to governing loading + corrosion
Joint E	Longitudinal seam joint efficiency
Load	
Internal	Circumferential stress due to internal pressure governs
External	External pressure governs
Wind	Combined longitudinal stress of pressure + weight + wind governs
Seismic	Combined longitudinal stress of pressure + weight + seismic governs

Weight Summary

Component	Weight (lb) Contributed by Vessel Elements										Surface Area ft ²	
	Metal New*	Metal Corroded	Insulation	Insulation Supports	Lining	Piping + Liquid	Operating Liquid		Test Liquid			
							New	Corroded	New	Corroded		
<u>TOP DISH</u>	122.6	122.6	36.7	0	0	0	714.8	714.8	632.5	632.5	22	
<u>SHELL_2</u>	129.6	129.6	26.9	0	0	0	1,307.8	1,307.8	1,157.4	1,157.4	17	
<u>SHELL_1</u>	444.3	444.3	92.1	0	0	0	4,484	4,484	3,968.2	3,968.2	57	
<u>BOTTOM DISH</u>	123.8	123.8	36.7	0	0	0	708.7	708.7	627.2	627.2	22	
<u>Legs #1</u>	120.5	120.5	0	0	0	0	0	0	0	0	18	
TOTAL:	940.8	940.8	192.4	0	0	0	7,215.4	7,215.4	6,385.2	6,385.2	136	

*Shells with attached nozzles have weight reduced by material cut out for opening.

Component	Weight (lb) Contributed by Attachments										Surface Area ft ²	
	Body Flanges		Nozzles & Flanges		Packed Beds	Ladders & Platforms	Trays	Tray Supports	Rings & Clips	Vertical Loads		
	New	Corroded	New	Corroded								
<u>TOP DISH</u>	0	0	58.7	58.7	0	0	0	0	0	0	4	
<u>SHELL_2</u>	0	0	0	0	0	0	0	0	0	0	0	
<u>SHELL_1</u>	0	0	0	0	0	0	0	0	0	0	0	
<u>BOTTOM DISH</u>	0	0	0	0	0	0	0	0	0	0	0	
<u>Legs #1</u>	0	0	0	0	0	0	0	0	0	0	0	
TOTAL:	0	0	58.7	58.7	0	0	0	0	0	0	4	

Vessel Totals		
	New	Corroded
Operating Weight (lb)	8,407	8,407
Empty Weight (lb)	1,192	1,192
Test Weight (lb)	7,577	7,577
Surface Area (ft ²)	140	-
Capacity** (US gal)	765	765

**The vessel capacity does not include volume of nozzle, piping or other attachments.

Vessel Lift Condition		
Vessel Lift Weight, New (lb)	1,000	
Center of Gravity from Datum (in)	28.2442	
Note: Vessel lift weight includes weight of insulation supports as they are assumed to be shop installed.		

Pressure Summary

Component Summary							
Identifier	P Design (psi)	T Design (°F)	MAWP (psi)	MAP (psi)	MDMT (°F)	MDMT Exemption	Impact Tested
<u>TOP DISH</u>	10	175	36.07	36.69	-320	Note 1	No
<u>Straight Flange on TOP DISH</u>	10	175	128.21	128.91	-320	Note 2	No
<u>SHELL 2</u>	10	175	95.54	96.82	-320	Note 3	No
<u>SHELL 1</u>	10	175	93.59	96.82	-320	Note 4	No
<u>Straight Flange on BOTTOM DISH</u>	10	175	125.6	128.91	-320	Note 6	No
<u>BOTTOM DISH</u>	10	175	33.01	36.69	-320	Note 5	No
<u>Legs #1</u>	10	175	10	N/A	N/A	N/A	N/A
<u>Nozzle #1 (N1)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #10 (N11)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #11 (N12)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #12 (N13)</u>	10	175	92.3	92.55	-55	Note 7	No
<u>Nozzle #2 (N2)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #3 (N3)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #4 (N4)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #5 (N5)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #6 (N6)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #7 (N7)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #8 (N8)</u>	10	175	92.14	92.55	-55	Note 7	No
<u>Nozzle #9 (N9)</u>	10	175	92.14	92.55	-55	Note 7	No

Chamber Summary	
Design MDMT	-20 °F
Rated MDMT	-20 °F @ 10 psi
MAWP hot & corroded	10 psi @ 175 °F
MAP cold & new	36.69 psi @ 70 °F
(1) The rated MDMT is limited to the design MDMT based on the setting in the Calculations tab of the Set Mode dialog. (2) This pressure chamber is not designed for external pressure.	

Notes for MDMT Rating		
Note #	Exemption	Details
1.	Impact test exempt per UHA-51(g) (coincident ratio = 0.1311)	
2.	Impact test exempt per UHA-51(g) (coincident ratio = 0.0661)	
3.	Impact test exempt per UHA-51(g) (coincident ratio = 0.0928)	
4.	Impact test exempt per UHA-51(g) (coincident ratio = 0.1089)	
5.	Impact test exempt per UHA-51(g) (coincident ratio = 0.169)	
6.	Impact test exempt per UHA-51(g) (coincident ratio = 0.0822)	
7.	Flange rating governs: Flange rated MDMT per UHA-51(d)(1)(a) = -320 °F Bolts rated MDMT per Fig UCS-66 note (c) = -55 °F	

Bill of Materials

Heads						
Item #	Type	Material	Thk [in]	Dia. [in]	Wt. [lb] (ea.)	Qty
H1	F&D Head	SA-240 316	0.125 (min.)	54 ID	123.8	2

Shells							
Item #	Type	Material	Thk [in]	Dia. [in]	Length [in]	Wt. [lb] (ea.)	Qty
S1	Cylinder	SA-240 316	0.1875	54 ID	14	129.6	1
S2	Cylinder	SA-240 316	0.1875	54 ID	48	444.3	1

Legs							
Item #	Type	Material	Thk [in]	Length [in]	Wt. [lb]	Qty	
L1	3x3x1/4 Equal Angle	SS 316	0.25	55	30.1	4	

Nozzles							
Item #	Type	Material	NPS	Thk [in]	Dia. [in]	Length [in]	Wt. [lb]
Noz1	Nozzle	SA-312 TP316 Wld pipe	NPS 1.5 Sch 40S (Std)	0.145	1.9 OD	30.9	7.2
Noz2	Nozzle	SA-312 TP316 Wld pipe	NPS 0.5 Sch 40S (Std)	0.109	0.84 OD	7.3	0.5
Noz3	Nozzle	SA-312 TP316 Wld pipe	NPS 1 Sch 40S (Std)	0.133	1.315 OD	7.5	1.1
Noz4	Nozzle	SA-312 TP316 Wld pipe	NPS 0.75 Sch 40S (Std)	0.113	1.05 OD	14.8	1.4
Noz5	Nozzle	SA-312 TP316 Wld pipe	NPS 2 Sch 40S (Std)	0.154	2.375 OD	30.6	9.5

Flanges							
Item #	Type	Material	NPS	Dia. [in]	Wt. [lb] (ea.)	Qty	
AF1	ASME B16.5 Slip On - Class 150	A182 F316	1 1/2	5 x 1.95	3	4	
AF2	ASME B16.5 Slip On - Class 150	A182 F316	1/2	3.5 x 0.88	1	1	
AF3	ASME B16.5 Slip On - Class 150	A182 F316	1	4.25 x 1.36	2	1	
AF4	ASME B16.5 Slip On - Class 150	A182 F316	3/4	3.88 x 1.09	2	2	
AF5	ASME B16.5 Slip On - Class 150	A182 F316	2	6 x 2.44	5	4	

Fasteners					
Item #	Description	Material	Length [in]	Qty	
FB1	1/2" coarse bolt	SA-193 B7 Bolt <= 2 1/2	2.5	16	
FB2	1/2" coarse bolt	SA-193 B7 Bolt <= 2 1/2	2	12	
FB3	1/2" coarse bolt	SA-193 B7 Bolt <= 2 1/2	2.3	4	
FB4	5/8" coarse bolt	SA-193 B7 Bolt <= 2 1/2	2.8	16	
SB1	5/8" coarse bolt	SA 193 GR B7	-	4	

All listed flange bolts require associated nuts and washers in accordance with Division 1, UCS-11.

Insulation				
Item #	Thk [in]	Density [lb/cu ft]	Wt. [lb]	Qty [ft ²]
IN1	2	9.36	192.4	123.35
Plates				
Item #	Material	Thk [in]	Wt. [lb]	Qty [ft ²]
Plate1	SS 316	0.1875	23.8	3.11
Plate1 - Note: Applies to support leg plates				
Plate2	SS 316	0.25	7.1	0.69
Plate2 - Note: Applies to support leg base plates				

Legs #1

Inputs	
Leg material	SS 316
Leg description	3x3x1/4 Equal Angle (Leg in)
Number of legs, N	4
Overall length	55"
Base to girth seam length	45"
User defined leg eccentricity	1.1"
Effective length coefficient, K	1.5
Coefficient, C _m	0.85
Leg yield stress, F _y	26,700 psi
Leg elastic modulus, E	27,653,846 psi
Angular Position	0°
Anchor Bolts	
Anchor bolt size	0.625" coarse threaded
Anchor bolt material	SA 193 GR B7
Bolt circle, BC	52.375"
Anchor bolts/leg, n	1
Anchor bolt allowable stress, S _b	20,000 psi
Anchor bolt corrosion allowance	0"
Anchor bolt hole clearance	0.375"
Reinforcing Pad	
Pad length	14"
Pad width	8"
Pad thickness	0.1875"
Base Plate	
Base plate length	5"
Base plate width	5"
Base plate thickness	0.25" (0.2305" required)
Base plate allowable stress	24,000 psi
Foundation allowable bearing stress	1,658 psi
Welds	
Leg to pad fillet weld	0.1875" (0.0215" required)
Pad to shell fillet weld	0.1875" (0.0085" required)