



Design Rerate Approval Form

SBU: DCSE		SHEET 1 OF 1	
PROJECT NO.:		DATE: 8/6/04	
PLANT: Beaumont Industrial Park		NAME: Absorber Column	
EQUIPMENT ENGINEERING NO.: 1801-7012-01		EXISTING DRAWING: JN-D-12804	
BUILDING OR AREA: Aniline		BPF: 143955	
DESCRIPTION OF RERATE REQUEST:			
	EXISTING	REQUEST	APPROVAL
DESIGN PRESSURE (PSIG)	125	135	135
DESIGN TEMP. °F	200	200	200
CORR. ALLOWANCE (IN.)	0	0	0
FINAL TEST PRESS. (PSIG)	190	190 (1.3 x DP)	190 (1.3 x DP) * 175.5
HEAT TREATED: YES ☐ NO ☒		RADIOGRAPHY: NONE ☐ SPOT ☒ FULL ☐	
MATERIAL: 304 Stainless Steel			
MODIFICATIONS REQUIRED: None			
WEAKEST PART OF EQUIPMENT: 1.5" Noz. Reinf. S1-S35			
MODIFICATIONS MADE BY: _____			
FINAL TEST AT _____ PSIG		DATE: _____	
CALCULATIONS MADE BY: Walter S. Almon CALCULATIONS CHECKED BY: Walter S. Almon CALCULATIONS APPROVED BY: Walter S. Almon <i>Walter S. Almon 8/13/04</i>			
SKETCH ATTACHED: YES ☐ NO ☒			
REMARKS: The approval of the increase in the vessel internal pressure is based on the thickness readings taken during the latest inspection report. * Meets Hydrotest Requirements for Rerate per API 510, para 7.3 (c). Needs approval of API Inspector. The Authorized Pressure Vessel Inspector shall oversee the attachment of an additional nameplate per API 510, para 7.3.			
TEST CONDUCTED BY: _____		TEST GROUP REPRESENTATIVE _____	
WITNESS & ACCEPTANCE BY: <i>Walter Dong 8/16/04</i>		PLANT REPRESENTATIVE _____	
CONFIRMATION RECEIVED BY ENGRG. DEPT.: _____		DATE: <i>8-18-04</i>	
DISPOSITION OF RECORD TO BPF: _____		FILE: <i>8-18-04</i>	

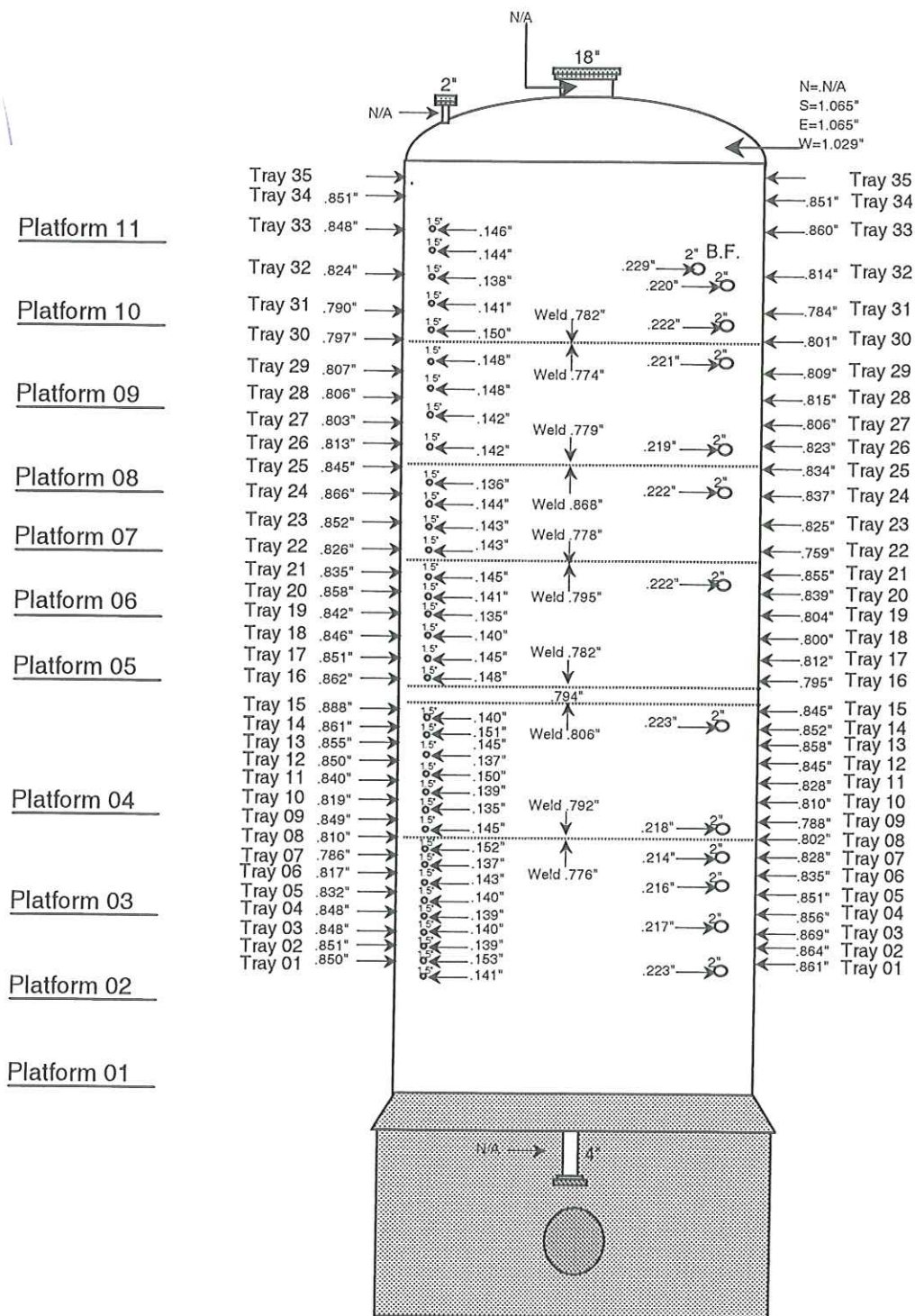


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MATERIAL: 304 Stainless Steel			
MODIFICATIONS REQUIRED: None			
WEAKEST PART OF EQUIPMENT: 1.5" Noz. Reinf. S1-S35			
MODIFICATIONS MADE BY: _____			
FINAL TEST AT _____ PSIG		DATE: _____	
CALCULATIONS MADE BY: Walter S. Almon		<i>Walter S. Almon 8/13/04</i>	
CALCULATIONS CHECKED BY: Walter S. Almon			
CALCULATIONS APPROVED BY: Walter S. Almon			
SKETCH ATTACHED: YES ☐ NO ☒			
REMARKS: The approval of the increase in the vessel internal pressure is based on the thickness readings taken during the latest inspection report. * Meets Hydrotest Requirements for Rerate per API 510, para 7.3 (c). Needs approval of API Inspector. The Authorized Pressure Vessel Inspector shall oversee the attachment of an additional nameplate per API 510, para 7.3.			
TEST CONDUCTED BY: _____		TEST GROUP REPRESENTATIVE	
WITNESS & ACCEPTANCE BY: <i>Mike Dory 8/16/04</i>		PLANT REPRESENTATIVE	
CONFIRMATION RECEIVED BY ENGRG. DEPT.: _____		DATE: <i>8-18-04</i>	
DISPOSITION OF RECORD TO BPF: _____		FILE: <i>8-18-04</i>	

w ←

Absorber Column
1801-7012-01



Additional Comments:

W ←

Absorber Column
1801-7012-01

Platform 11

Platform 10

Platform 09

Platform 08

Platform 07

Platform 06

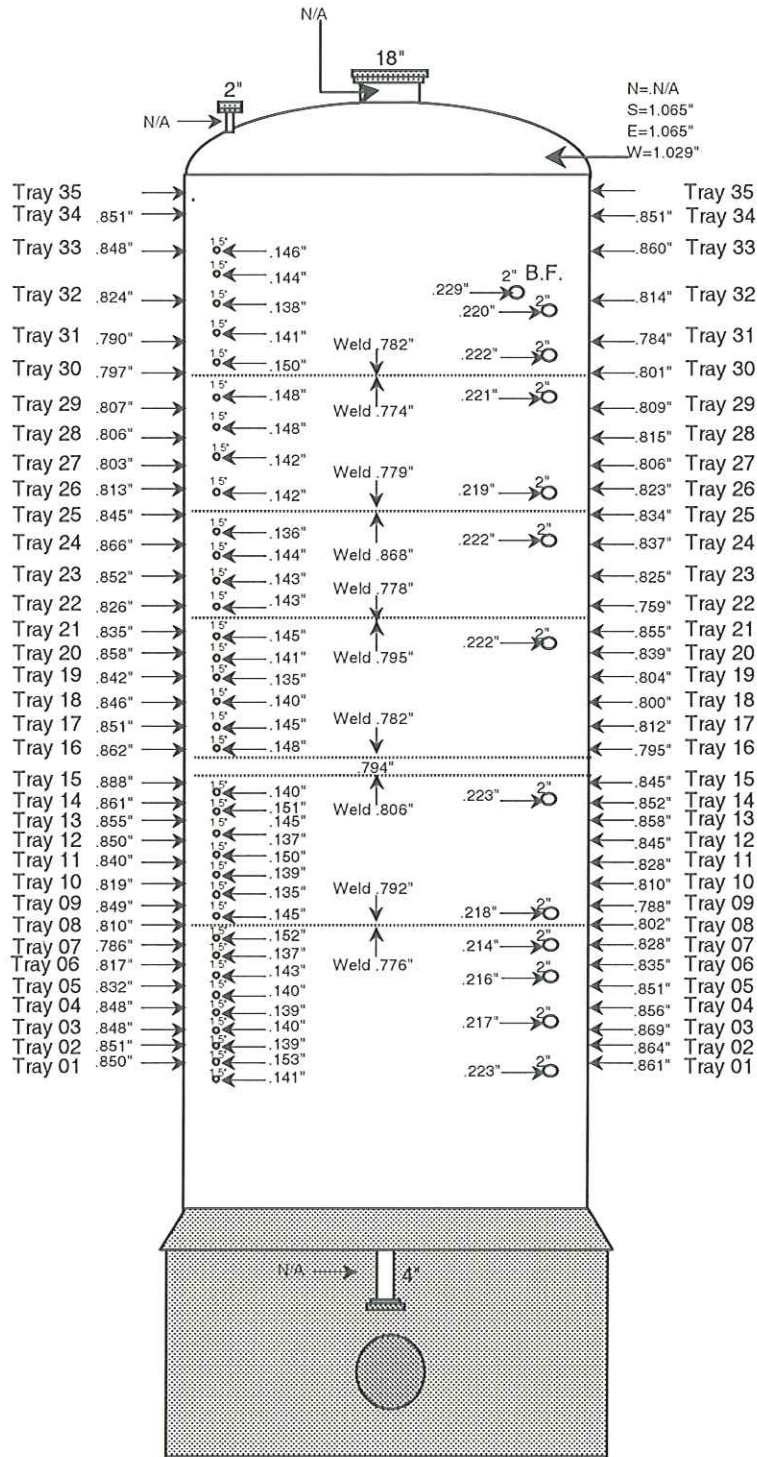
Platform 05

Platform 04

Platform 03

Platform 02

Platform 01

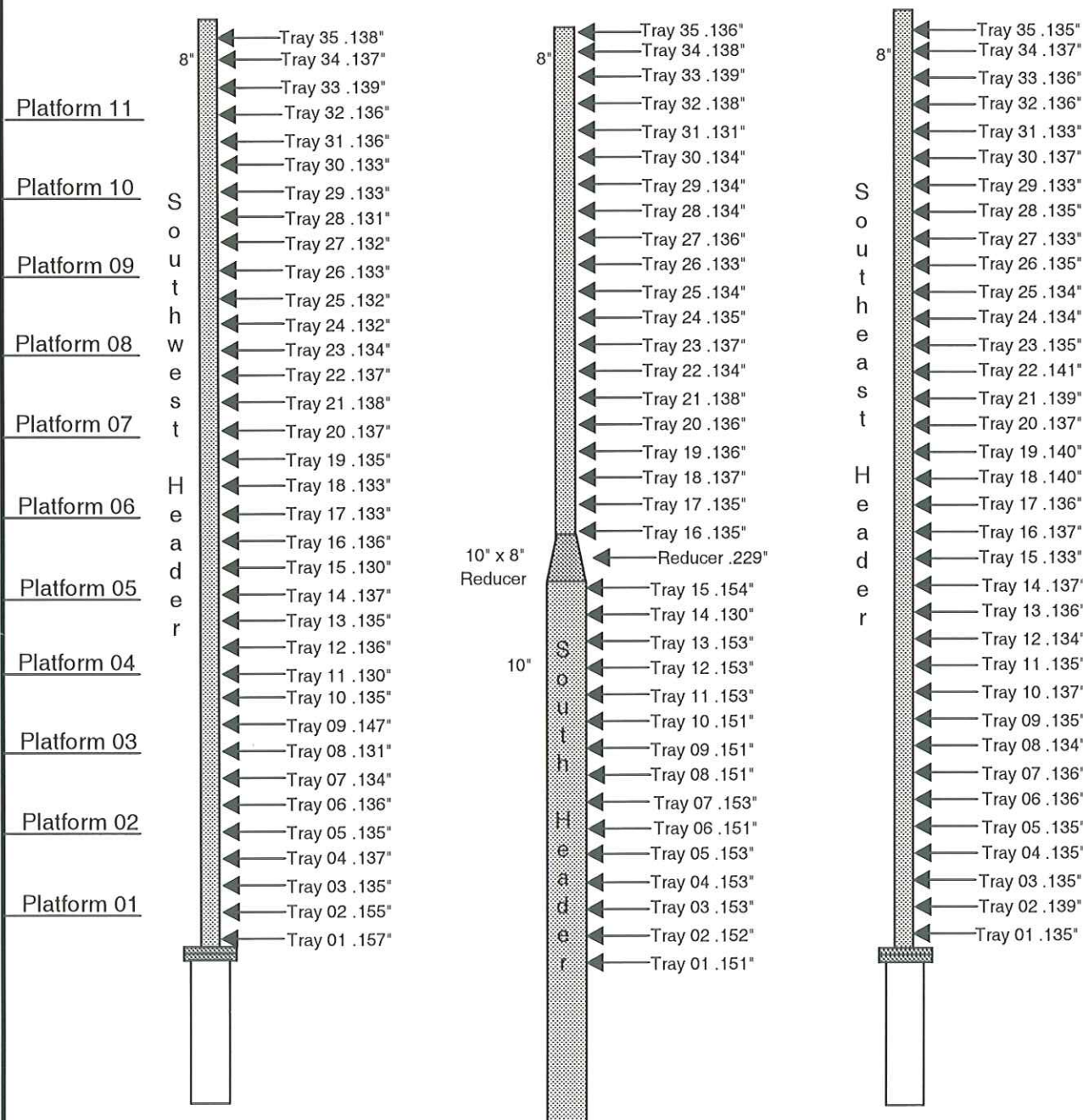


Additional Comments:

DuPont Beaumont Specialty Chemicals	Aniline Unit; AOP Sub Area	Date:06/16/03
Equipment Name: Absorber Column		
Equipment FAA#: 1801-7012-01		

W ←

Readings were taken on the Stainless Steel Sch. 10s Headers and lowest readings recorded, Nominal Thickness .148"



Additional Comments:

API 510 REPAIR ALTERATION OR RERATING OF PRESSURE VESSEL FORM

Form Date 8/13/04

Form No. 1

Owner or User Name DuPont Bmt. Works

Vessel Name Absorber Column

1. Original Vessel Identification Number 1801-7012-01
2. Original Vessel Location Aniline – Area, AOP – Sub-Area
3. Manufacturer Nooter
4. See attachments for additional data? Yes ☐ No ☒
5. Original Construction Code
6. Original Maximum Allowable Working Pressure 125 PSIG Year Built 1992
7. Original Design Temperature 200 F Year Built 1992
8. Original Minimum Design Metal Temperature At Pressure
9. Original Test Pressure 190 Fluid Gas Position
10. Shell Material 304 SS Head Material
11. Shell Thickness 0.780" Head Thickness 1.029"
12. Original Joint Efficiency
13. Original Radiography Yes Spot No ☐
14. Original PWHT Yes ☐ No ☒
- If yes, Temp (°F) Time (hrs)
15. Original Corrosion Allowance NONE
16. Work on Vessel Classified as Repair ☐ Alteration ☐ Rerating ☒
18. Construction Code for Present 2001 EDITION ASME SECTION VIII DIV. 1
19. New Vessel Identification Number (if applicable)
20. New Vessel Location (if applicable)
21. New Maximum Allowable Working Pressure 135 PSIG
22. New Design Temperature 200 F
23. New Minimum Design Metal Temperature At Pressure
24. New PWHT ☐ Yes ☒ No
- Temp (°F) Time (Hrs)
25. New Joint Efficiency, if applicable E=
26. Type of Examination or Inspection Performed:

☐ Radiographic	☐ Ultrasonic
☐ Magnetic Particle	☐ Penetrant
☒ Visual	☒ Other *Based on prior NDT inspections.
27. New Pressure Test if Yes, Pressure NONE Test Medium Test Position
28. New Corrosion Allowance
29. Describe work performed (attach drawings, calculations, and other pertinent data):

Statement of Compliance

We certify that the statements made in this report are correct and that all material and construction for and workmanship of this

☐ Repair ☐ Alteration ☒ Rerating conform to the requirements of the Latest Edition of API 510, Pressure Vessel Inspection Code.

DuPont Bmt. Works

(repair, alteration, or rerating organization)

Signed

(authorized representative)

Date

Statement of Inspection

I, the undersigned, an inspector employed by DUPONT Having inspected the work described the work above, state that to the best of my knowledge, the work has been satisfactorily completed in accordance with the

ADDENDUM 1 ERRATA 1999 Edition of API 510, Pressure Vessel Inspection Code.

Signed: *Mike Doug*
API 510 Certification Number: 5058

Date: 8/14/04

Equipment Information Form

General Information:

Area: Aniline		Sub-Area: > AOP	
Equipment Name: > Absorber Column			
Equipment FAA#: > 1801-7012-01			
External Inspection: > 2 yrs		Internal Inspection: > WARRANTED	
Nat. Brd. #: > 12325	Mfg. Serial #: > 913417	Year Built: > 1992	
Fabricator: > NOOTER CORPORATION; 1400 S. 3rd ST.; ST. LOUIS, MISSOURI			
Project #: > 9157		Drawing #: > JND-70964	
BPF Drawing #: > 305829		BPF# Assigned: > Yes ☒ No ☐	
P&I Drawings #: > B161026		P&I Drawing Updated: > Yes ☒ No ☐	
Equipment Size: > 10'-6" DIA X 68'-11-1/4" HEIGHT			
Equipment Position: > VERTICAL		Equipment Weight: >	
Design Pressure (Shell): > 125 PSI		Design Temperature (Shell): > 200 °F	
Hydro. Test Pressure (Shell): > 190 PSI			
Design Pressure (Tubes): > N/A		Design Temperature (Tubes): > N/A	
Hydro. Test Pressure (Tubes): > N/A			

Material of Construction:

Equipment Type: > VERTICAL ABSORBER		# of Courses (Tank): > 7	
Material of Construction: > SA-240-304L		Area of: > SHELL	
Design Thickness: > 3/4"		Corrosion Allowance: > NONE	
Material of Construction: > SA-240-304L		Area of: > HEADS	
Design Thickness: > 7/8"		Corrosion Allowance: > NONE	
Material of Construction: >		Area of: >	
Design Thickness: >		Corrosion Allowance: >	
Material of Construction: >		Area of: >	
Design Thickness: >		Corrosion Allowance: >	
Tubesheet Material: >			
Tubesheet Size: >		Tubesheet Design Thickness: >	
Tubesheet Corrosion Allowance: >		Tubesheet (Facing of Tubes): >	
Tubes Material: >			
Tubes Size: >		Tubes Design Thickness: >	
# of Tubes: >		Type of Tubes: >	
Baffles Material: >		Tie Rods Material: >	
Flange Material: > SA-182-F-304L			
Gasket Material: >			
Nozzle Material: > SA-312-304L			
NOTE: REINF. PAD 3/8" THK (SA-240-304L) w/ 1/8" NPT			

Expansion Joint Information:

Expansion Joint Name:		
Expansion Joint FAA#:		
Inspection Frequency: >		Expansion Joint Type: >
Fabricator: >		
Size: >	Design Thickness: >	# of Bellows: >
Material: >	Life Cycles: >	Date Installed: >

Absorber Col.



Inspection Department

From the Desk of Rusty Wright

Subject: Re-Rate Document(1801-7012-01)

**This exchanger has been re-rated in Aniline (Sub-Area A.O.P.)
2.Re-Rate to 135PSI / 200F**

Rerate By: Wes Eastham API 5022

MAWP 135 psi @ 200 °F

Date 04/20/04

1801-7012-01

PRESSURE VESSEL CALCULATIONS

Vessel Name: 1801-7012-01

Vessel Desc: ABSORBER COLUMN (NITRIC ACID)

08/12/2004 15:04:07

VESSEL NAME: 1801-7012-01 VESSEL DESC: ABSORBER COLUMN (NITRIC ACID)

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*****
*
*   DATE OF EVALUATION: 11/07/2003           EVALUATED BY: WALTER S. ALMON   *
*
*   DATE OF APPROVAL:    08/12/2004           APPROVED BY:  WALTER S. ALMON   *
*
*****
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Note for Vessel: 1801-7012-01
Memo Name: REPLACEMENT VESSEL!!
Written by WALTER S. ALMON on 11/07/2003

This absorber column was replaced in 1992, fabricated by Nooter. Original column also fabricated by Nooter in 1956. The 1992 design is identical, as much as possible, to the 1956 design.

Note for Vessel: 1801-7012-01
Memo Name: COLUMN INFORMATION
Written by WALTER S. ALMON on 11/02/2003

NAME: ABSORBER COLUMN (NITRIC ACID)

FAA NO.: 1801-7012-1

VESSEL TYPE: COLUMN

DESIGN CONDITIONS: 125 PSIG @ 200F, 0 CORROSION ALLOWANCE

HYDROTEST PRESSURE: 190 PSIG

MATERIAL: 304 STAINLESS STEEL

YEAR BUILT: 1992

MANUFACTURER: NOOTER, ST. LOUIS, MISSOURI.

MANUFACTURER'S NO: 913417 NATIONAL BOARD NO.: 12325

DIAMETER: 10'-6" I.D

EIGHT: 69'-0"

BPF: LBP64962

Note for Vessel: 1801-7012-01

Memo Name: SMALL NOZZLE REINFORCEMENT

Written by WALTER S. ALMON on 11/01/2003

The 1.5" nozzles S1 -> S35, along with the 2" nozzles, are deemed to be adequately reinforced per UG-36(c)(3), as they are smaller than 3" nozzles. The nozzle-to-shell welds are too small per UW-15. However, the strength of the welds for possible paths of failure, per UG-41, are quite adequate, at least twice as strong as needed.

The 1.5" nozzles have experienced little corrosion. Schedule 40 is 0.145". The thinnest nozzle wall is 0.135" (Sch 40 is 0.145") on S11 and S20, which gives an MAWP of 127 psig, per UG-37 methods (again, this analysis is not required per UG-36(c)(3)).

The 2" nozzles B1-B12, and G&H, have also not experienced much, if any, corrosion. The thinnest one is B4 with a wall thickness of 0.214" (Sch 80 is 0.218"). The MAWP goes from 128 psig to 127 psig.

The above small nozzle calculations are based on one of the thinnest shell wall thickness readings found, 0.792". Much of the shell wall is well over 0.80" thick, which will increase the MAWP of the nozzle several psi.

Based on these two evaluations, consider the small nozzle reinforcements adequate for 135 psig. Inadequate fillet welds due to small size per UW-15 are considered adequate on the larger nozzles, due to very adequate strength of welds.

NOTE: ACTUAL, MEASURED THICKNESSES ARE USED IN THE ANALYSES, TAKEN FROM THE LATEST INSPECTION REPORT, DATED 6/16/03.

PRESSURE VESSEL CALCULATIONS

Vessel Name: 1801-7012-01

Vessel Desc: ABSORBER COLUMN (NITRIC ACID)

08/12/2004 15:04:07

AREA: AOP Eq/Circ ID: 1801-7012-01 Section: INTERNAL

DESIGN PRESSURE: 125 PSI

MAXIMUM DESIGN TEMPERATURE: 200 DEGREES F

DESIGN CORROSION ALLOWANCE: 0.0000 INCHES

YEAR BUILT: 1992

--WARNING!---NOZZLE-TO-SHELL (OR REPAD) WELD, WELD OS,

IS TOO SMALL. ANALYSIS:

8"-150LB NOZ RNF "N"

--WARNING!---REPAD-TO-SHELL WELD, WELD PD, IS TOO SMALL.

ANALYSIS:

18"-150LB MANWAY RNF "M"

18"-150LB NOZ REINF "T1-T2"

4"150LB NOZ RNF "D1" W/2"

8"-150LB NOZ RNF "N"

18"-150LB NOZ RNF "A" TOP HE

4"-150LB NOZ RNF "O" BOT HEA

COMPONENT SUMMARY	CORRODED- THK	RQD THK	= EXCESS CALC CA	MAWP	STRESS
SHELL - BOTTOM	0.820	0.532	0.288	193.2	
SHELL - TOP	0.780	0.532	0.248	183.7	
BOTTOM HEAD, FLG-DISH	1.029	0.731	0.298	175.9	
TOP HEAD, FLG-DISH	1.029	0.731	0.298	175.9	
1.5" NOZ RNF S1 - S35				132.0	
1.5" NOZ RNF S11 20 @ 0.135"				133.0	
1.5" NOZ RNF S2				132.0	
18"-150LB MANWAY RNF "M"				158.4	
18"-150LB NOZ REINF "T1-T2"				158.4	
2"-150LB NOZ RNF "B1-B12"				134.0	
2"-150LB NOZ RNF "B4"@ 0.214				133.0	
2"-150LB NOZ RNF "G" AND "H"				134.0	
4"150LB NOZ RNF "D1" W/2"				174.0	
8"-150LB NOZ RNF "N"				164.6	

18"-150LB NOZ RNF "A" TOP HE	182.2
3"-150LB NOZ RNF "C" TOP HEA	190.0
4"-150LB NOZ RNF "O" BOT HEA	218.0
WINDLOAD	385.4
TOWER IN TENSION	385.4
TOWER IN COMPRESSION	678.4
WIND MOMENT @ SHELL/SKIRT JUNCTION, FT-LBF	1229855.
WIND MOMENT @ BASERING, FT-LBF	1606301.
WIND MOMENT @ GRADE, FT-LBF	1856242.
150LB FLANGES	235.0

INPUT DATA SUMMARY

SHELL - BOTTOM

CYLINDRICAL SHELL MATERIAL: SA-240-304

SHEL OD	SHEL TK	S	SRF	E
127.750	0.820	17800.	1.00	0.85

SHELL - TOP

CYLINDRICAL SHELL MATERIAL: SA-240-304

SHEL OD	SHEL TK	S	SRF	E
127.750	0.780	17800.	1.00	0.85

BOTTOM HEAD, FLG-DISH

HEAD MATERIAL: SA-240-304

HEAD OD	HEAD TK	S	SRF	E	KN RAD
127.750	1.029	17800.	1.00	1.00	7.750
L					
120.00					

TOP HEAD, FLG-DISH

HEAD MATERIAL: SA-240-304

HEAD OD	HEAD TK	S	SRF	E	KN RAD
127.750	1.029	17800.	1.00	1.00	7.750
L					
120.00					

1.5" NOZ RNF S1 - S35

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	1.900	0.145	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

1.5" NOZ RNF S11 20 @ 0.135"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.806	1.900	0.135	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

1.5" NOZ RNF S2

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	1.900	0.145	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

18"-150LB MANWAY RNF "M"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	18.000	0.562	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	28.000	0.375	0.375	0.000
WELD PD	DIST OB				
0.250	0.000				

18"-150LB NOZ REINF "T1-T2"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	18.000	0.562	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	28.000	0.375	0.375	0.000
WELD PD	DIST OB				
0.250	0.000				

2"-150LB NOZ RNF "B1-B12"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	2.375	0.218	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

2"-150LB NOZ RNF "B4"@ 0.214"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	2.375	0.214	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

2"-150LB NOZ RNF "G" AND "H" SHELL MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	2.375	0.218	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

4"150LB NOZ RNF "D1" W/2" SHELL MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	4.500	0.237	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	8.500	0.375	0.250	0.000
WELD PD	DIST OB				
0.250	0.000				

8"-150LB NOZ RNF "N" SHELL MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	8.625	0.322	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	14.625	0.375	0.250	0.000
WELD PD	DIST OB				
0.250	0.000				

18"-150LB NOZ RNF "A" TOP HEAD HEAD MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-240-304

L	HEAD TK	NOZ OD	NOZ THK	IN PROJ	SRF
120.00	1.029	18.000	0.562	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	22.000	0.375	0.375	0.000
WELD PD	DIST OB				
0.250	0.000				

2"-150LB NOZ RNF "C" TOP HEAD HEAD MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-240-304

L	HEAD TK	NOZ OD	NOZ THK	IN PROJ	SRF
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120.00	1.029	2.375	0.218	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

4"-150LB NOZ RNF "O" BOT HEAD HEAD MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-240-304

L	HEAD TK	NOZ OD	NOZ THK	IN PROJ	SRF
120.00	1.029	4.500	0.237	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	8.500	0.375	0.250	0.000
WELD PD	DIST OB				
0.250	0.000				

WINDLOAD

LOWER TOWER MATERIAL: SA-240-304

HP	HS	H1	DOS1	TS 1	SS 1
5.999	9.999	70.000	127.750	0.850	17800.
ES 1	DX 1	H2	DOS2	TS 2	DX 2
0.700	32.000	0.000	0.000	0.000	0.00
W	V	I	EXPOS	MI	TABLE
99999.	115.0	1.07	2	0.0	328.1

150LB FLANGES

RATING FLANGE MATERIAL
150# SA-182-F304



Process Equipment Network

SG6A Design Rerate Approval Form

Completion of the design rerate form is the responsibility of the pressure vessel designer or engineer who is doing the rerating calculations. The form is then submitted with the backup calculations and drawings for approval by the responsible plant personnel. After all approvals are obtained, any modifications made and retests carried out, the rerate form along with the API or NB rerate certificate, modified drawings and calculations are added to the equipment BPF

A. Scope

This specification provides an outline Engineering Design Rerate form for use in rerating vessels, tanks and heat exchangers.

B. Instructions

Provide the required data in the spaces provided and sign off the printed form in approval blocks. Attach the backup calculations and drawings and transmit to the plant for approval and final disposition.

PRESSURE VESSEL CALCULATIONS

Vessel Name: 1801-7012-01

Vessel Desc: ABSORBER COLUMN (NITRIC ACID)

08/12/2004 15:04:07

VESSEL NAME: 1801-7012-01 VESSEL DESC: ABSORBER COLUMN (NITRIC ACID)

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*****
*
*   DATE OF EVALUATION: 11/07/2003           EVALUATED BY: WALTER S. ALMON   *
*
*   DATE OF APPROVAL:    08/12/2004           APPROVED BY:  WALTER S. ALMON   *
*
*****
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Note for Vessel: 1801-7012-01

Memo Name: REPLACEMENT VESSEL!!

Written by WALTER S. ALMON on 11/07/2003

This absorber column was replaced in 1992, fabricated by Nooter. Original column also fabricated by Nooter in 1956. The 1992 design is identical, as much as possible, to the 1956 design.

Note for Vessel: 1801-7012-01

Memo Name: COLUMN INFORMATION

Written by WALTER S. ALMON on 11/02/2003

NAME: ABSORBER COLUMN (NITRIC ACID)

FAA NO.: 1801-7012-1

VESSEL TYPE: COLUMN

DESIGN CONDITIONS: 125 PSIG @ 200F, 0 CORROSION ALLOWANCE

HYDROTEST PRESSURE: 190 PSIG

MATERIAL: 304 STAINLESS STEEL

YEAR BUILT: 1992

MANUFACTURER: NOOTER, ST. LOUIS, MISSOURI.

MANUFACTURER'S NO: 913417 NATIONAL BOARD NO.: 12325

DIAMETER: 10'-6" I.D

HEIGHT: 69'-0"

BPF: LBP64962

Note for Vessel: 1801-7012-01

Memo Name: SMALL NOZZLE REINFORCEMENT

Written by WALTER S. ALMON on 11/01/2003

The 1.5" nozzles S1 -> S35, along with the 2" nozzles, are deemed to be adequately reinforced per UG-36(c)(3), as they are smaller than 3" nozzles. The nozzle-to-shell welds are too small per UW-15. However, the strength of the welds for possible paths of failure, per UG-41, are quite adequate, at least twice as strong as needed.

The 1.5" nozzles have experienced little corrosion. Schedule 40 is 0.145". The thinnest nozzle wall is 0.135" (Sch 40 is 0.145") on S11 and S20, which gives an MAWP of 127 psig, per UG-37 methods (again, this analysis is not required per UG-36(c)(3)).

The 2" nozzles B1-B12, and G&H, have also not experienced much, if any, corrosion. The thinnest one is B4 with a wall thickness of 0.214" (Sch 80 is 0.218"). The MAWP goes from 128 psig to 127 psig.

The above small nozzle calculations are based on one of the thinnest shell wall thickness readings found, 0.792". Much of the shell wall is well over 0.80" thick, which will increase the MAWP of the nozzle several psi.

Based on these two evaluations, consider the small nozzle reinforcements adequate for 135 psig. Inadequate fillet welds due to small size per UW-15 are considered adequate on the larger nozzles, due to very adequate strength of welds.

NOTE: ACTUAL, MEASURED THICKNESSES ARE USED IN THE ANALYSES, TAKEN FROM THE LATEST INSPECTION REPORT, DATED 6/16/03.

PRESSURE VESSEL CALCULATIONS
 Vessel Name: 1801-7012-01
 Vessel Desc: ABSORBER COLUMN (NITRIC ACID)
 08/12/2004 15:04:07

 AREA: AOP Eq/Circ ID: 1801-7012-01 Section: INTERNAL

DESIGN PRESSURE: 125 PSI
 MAXIMUM DESIGN TEMPERATURE: 200 DEGREES F
 DESIGN CORROSION ALLOWANCE: 0.0000 INCHES YEAR BUILT: 1992

--WARNING!---NOZZLE-TO-SHELL (OR REPAD) WELD, WELD OS,
 IS TOO SMALL. ANALYSIS:
 8"-150LB NOZ RNF "N"

--WARNING!---REPAD-TO-SHELL WELD, WELD PD, IS TOO SMALL.
 ANALYSIS:
 18"-150LB MANWAY RNF "M"
 18"-150LB NOZ REINF "T1-T2"
 4"150LB NOZ RNF "D1" W/2"
 8"-150LB NOZ RNF "N"
 18"-150LB NOZ RNF "A" TOP HE
 4"-150LB NOZ RNF "O" BOT HEA

COMPONENT SUMMARY	CORRODED- THK	RQD THK	=	EXCESS CALC CA	MAWP	STRESS
SHELL - BOTTOM	0.820	0.532		0.288	193.2	
SHELL - TOP	0.780	0.532		0.248	183.7	
BOTTOM HEAD, FLG-DISH	1.029	0.731		0.298	175.9	
TOP HEAD, FLG-DISH	1.029	0.731		0.298	175.9	
1.5" NOZ RNF S1 - S35					132.0	
1.5" NOZ RNF S11 20 @ 0.135"					133.0	
1.5" NOZ RNF S2					132.0	
18"-150LB MANWAY RNF "M"					158.4	
18"-150LB NOZ REINF "T1-T2"					158.4	
2"-150LB NOZ RNF "B1-B12"					134.0	
2"-150LB NOZ RNF "B4"@ 0.214					133.0	
2"-150LB NOZ RNF "G" AND "H"					134.0	
4"150LB NOZ RNF "D1" W/2"					174.0	
8"-150LB NOZ RNF "N"					164.6	

18"-150LB NOZ RNF "A" TOP HE	182.2
2"-150LB NOZ RNF "C" TOP HEA	190.0
4"-150LB NOZ RNF "O" BOT HEA	218.0
WINDLOAD	385.4
TOWER IN TENSION	385.4
TOWER IN COMPRESSION	678.4
WIND MOMENT @ SHELL/SKIRT JUNCTION, FT-LBF	1229855.
WIND MOMENT @ BASERING, FT-LBF	1606301.
WIND MOMENT @ GRADE, FT-LBF	1856242.
150LB FLANGES	235.0

 INPUT DATA SUMMARY

SHELL - BOTTOM CYLINDRICAL SHELL MATERIAL: SA-240-304

SHEL OD	SHEL TK	S	SRF	E
127.750	0.820	17800.	1.00	0.85

SHELL - TOP CYLINDRICAL SHELL MATERIAL: SA-240-304

SHEL OD	SHEL TK	S	SRF	E
127.750	0.780	17800.	1.00	0.85

BOTTOM HEAD, FLG-DISH HEAD MATERIAL: SA-240-304

HEAD OD	HEAD TK	S	SRF	E	KN RAD
127.750	1.029	17800.	1.00	1.00	7.750
L					
120.00					

TOP HEAD, FLG-DISH HEAD MATERIAL: SA-240-304

HEAD OD	HEAD TK	S	SRF	E	KN RAD
127.750	1.029	17800.	1.00	1.00	7.750
L					
120.00					

 1.5" NOZ RNF S1 - S35 SHELL MATERIAL: SA-240-304
 NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	1.900	0.145	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

 1.5" NOZ RNF S11 20 @ 0.135" SHELL MATERIAL: SA-240-304
 NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.806	1.900	0.135	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

1.5" NOZ RNF S2

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	1.900	0.145	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

18"-150LB MANWAY RNF "M"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	18.000	0.562	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	28.000	0.375	0.375	0.000
WELD PD	DIST OB				
0.250	0.000				

18"-150LB NOZ REINF "T1-T2"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	18.000	0.562	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	28.000	0.375	0.375	0.000
WELD PD	DIST OB				
0.250	0.000				

2"-150LB NOZ RNF "B1-B12"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	2.375	0.218	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

2"-150LB NOZ RNF "B4"@ 0.214"

SHELL MATERIAL: SA-240-304

NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	2.375	0.214	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

2"-150LB NOZ RNF "G" AND "H" SHELL MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	2.375	0.218	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

4"150LB NOZ RNF "D1" W/2" SHELL MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	4.500	0.237	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	8.500	0.375	0.250	0.000
WELD PD	DIST OB				
0.250	0.000				

8"-150LB NOZ RNF "N" SHELL MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-312-RP304

SHEL OD	SHEL TK	NOZ OD	NOZ THK	IN PROJ	SRF
127.750	0.792	8.625	0.322	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	14.625	0.375	0.250	0.000
WELD PD	DIST OB				
0.250	0.000				

18"-150LB NOZ RNF "A" TOP HEAD HEAD MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-240-304

L	HEAD TK	NOZ OD	NOZ THK	IN PROJ	SRF
120.00	1.029	18.000	0.562	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	22.000	0.375	0.375	0.000
WELD PD	DIST OB				
0.250	0.000				

2"-150LB NOZ RNF "C" TOP HEAD HEAD MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-240-304

L	HEAD TK	NOZ OD	NOZ THK	IN PROJ	SRF
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120.00	1.029	2.375	0.218	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	0.000	0.000	0.250	0.000
WELD PD	DIST OB				
0.000	0.000				

4"-150LB NOZ RNF "O" BOT HEAD HEAD MATERIAL: SA-240-304
NOZZLE MATERIAL: SA-240-304

L	HEAD TK	NOZ OD	NOZ THK	IN PROJ	SRF
120.00	1.029	4.500	0.237	0.000	1.00
S	NOZ S	PAD OD	PAD THK	WELD OS	WELD IS
17800.	17800.	8.500	0.375	0.250	0.000
WELD PD	DIST OB				
0.250	0.000				

WINDLOAD

LOWER TOWER MATERIAL: SA-240-304

HP	HS	H1	DOS1	TS 1	SS 1
5.999	9.999	70.000	127.750	0.850	17800.
ES 1	DX 1	H2	DOS2	TS 2	DX 2
0.700	32.000	0.000	0.000	0.000	0.00
W	V	I	EXPOS	MI	TABLE
99999.	115.0	1.07	2	0.0	328.1

150LB FLANGES

RATING FLANGE MATERIAL
150# SA-182-F304