

Manufacturer's Data Book

9033982-02-MDB

Customer Name: UOP Russell LLC

Customer Purchase Order: 4500753897

Customer Project Name: -

Customer Project Number: J-447

Plant: Curtis Kelly, Inc.

Customer's Client: -

Sulzer Project Number: 9033982

Component/Service: Demethanizer Tower

Column/Vessel Number: T-501

Year Built: 2017

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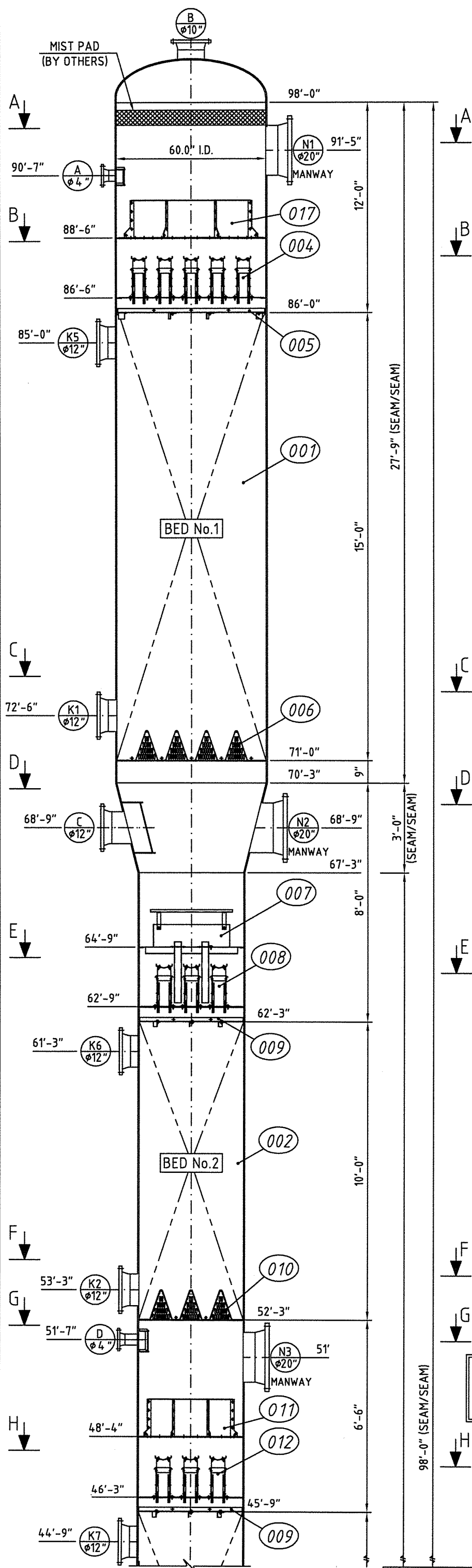
Manufacturer's Data Book
9033982-02-MDB

Section	Title
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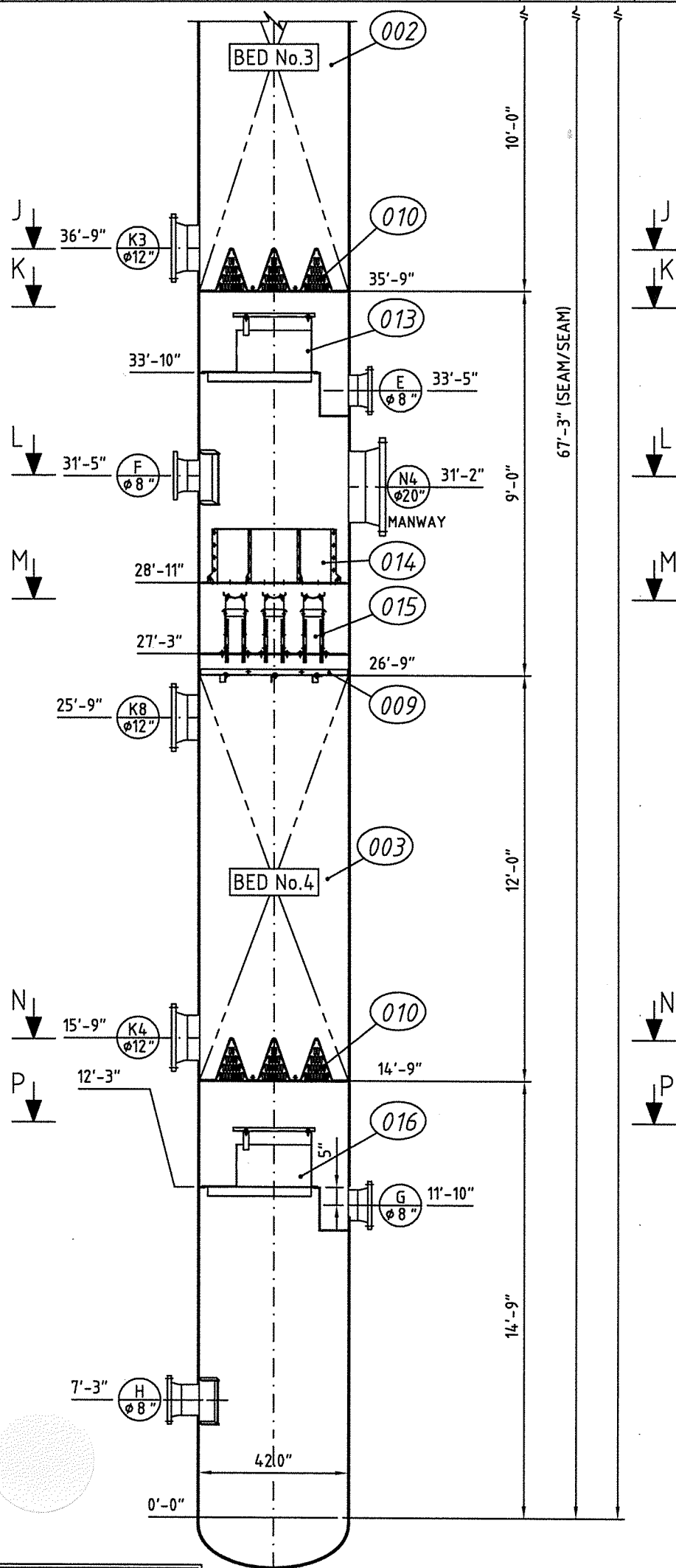
- | | |
|---|--|
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| 2 | Hydraulic Calculations |
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| 4 | Shipping Documents |
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Section 1

Drawings



item list								
item	set	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000		1	SET		GENERAL ARRANGEMENT			10000
001	318	-	FT3	203	No.2.0 NEXRINGS PACKING	BEDS No. 1	304	-
002	208	-	FT3	209	No.2.0 NEXRINGS PACKING	BEDS No. 2 & 3	304	-
003	125	-	FT3	216	No.1.5 NEXRINGS PACKING	BEDS No. 4	304	-
004	1	-	SET	SHEET No.04	VSIR DISTRIBUTOR	BED No.1	304L / 316L	400
005	1	-	SET	SHEET No.05	RPB BED LIMITER	BED No.1	304L / 316L	42
006	1	-	SET	SHEET No.06	GIS SUPPORT PLATE	BED No.1	304L	225
007	1	-	SET	SHEET No.07	SKH COLLECTOR TRAY	BED No.2	304L	153.5
008	1	-	SET	SHEET No.08	VSIR DISTRIBUTOR	BED No.2	304L / 316L	187
009	3	-	SETS	SHEET No.09	RPB BED LIMITER	BEDS No.2, 3, & 4	304L	50
010	3	-	SETS	SHEET No.10	GIS SUPPORT PLATE	BEDS No.2, 3, & 4	304L	132
011	1	-	SET	SHEET No.11	SKG GALLERY TRAY	BED No.3	304L	112.5
012	1	-	SET	SHEET No.12	VSIR DISTRIBUTOR	BED No.3	304L / 316L	187
013	1	-	SET	SHEET No.13	SKHW COLLECTOR TRAY	BED No.3	304L	120
014	1	-	SET	SHEET No.14	SKG GALLERY TRAY	BED No.4	304L	112.5
015	1	-	SET	SHEET No.15	VSIR DISTRIBUTOR	BED No.4	304L / 316L	187
016	1	-	SET	SHEET No.16	SKHW COLLECTOR TRAY	BED No.4	304L	120
017	1	-	SET	SHEET No.03	SKG GALLERY TRAY	BED No.1	304L	126



DUPLICATE OF SULZER JOB No.9018614--02
 WITH THE FOLLOWING CHANGES:
 A. PACKING TYPE CHANGED TO NEXRING
 (WAS NUTTER RING)
 B. ITEM 009 WIRE CLOTH SIZE CHANGED.

THIS DRAWING IS TO BE READ IN
CONJUNCTION WITH SHEETS No.02 & 02a.

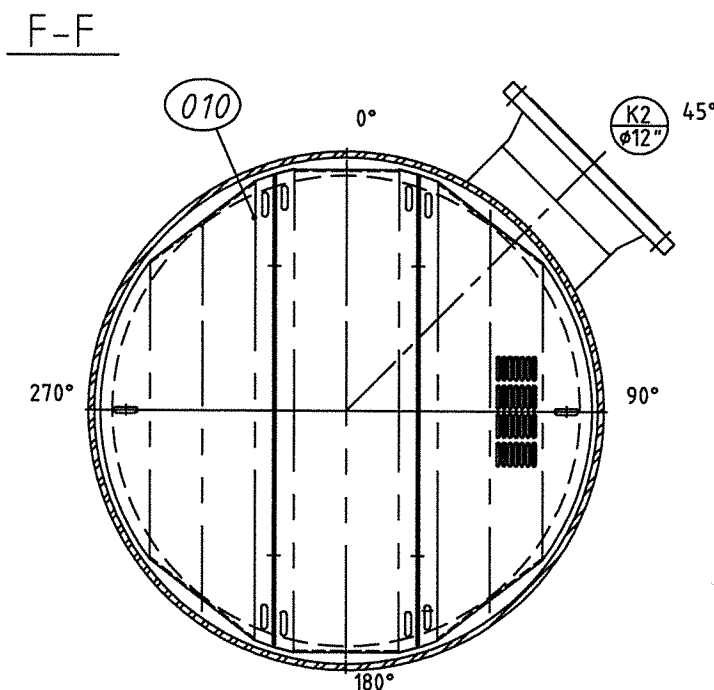
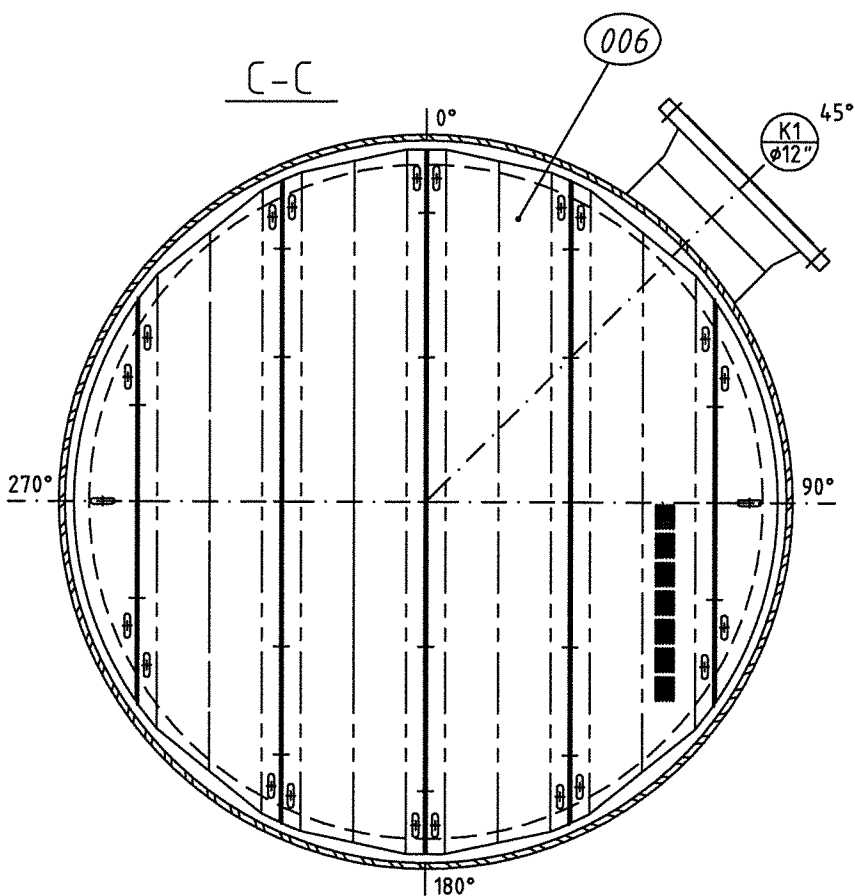
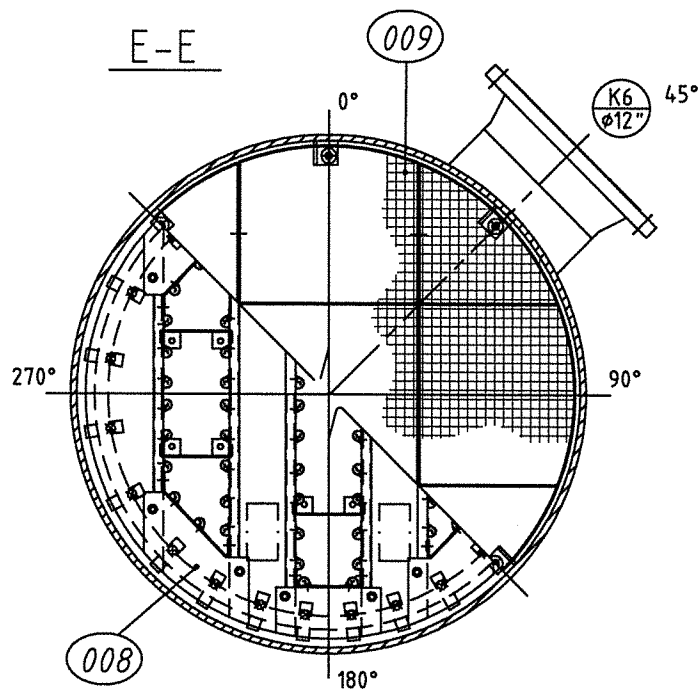
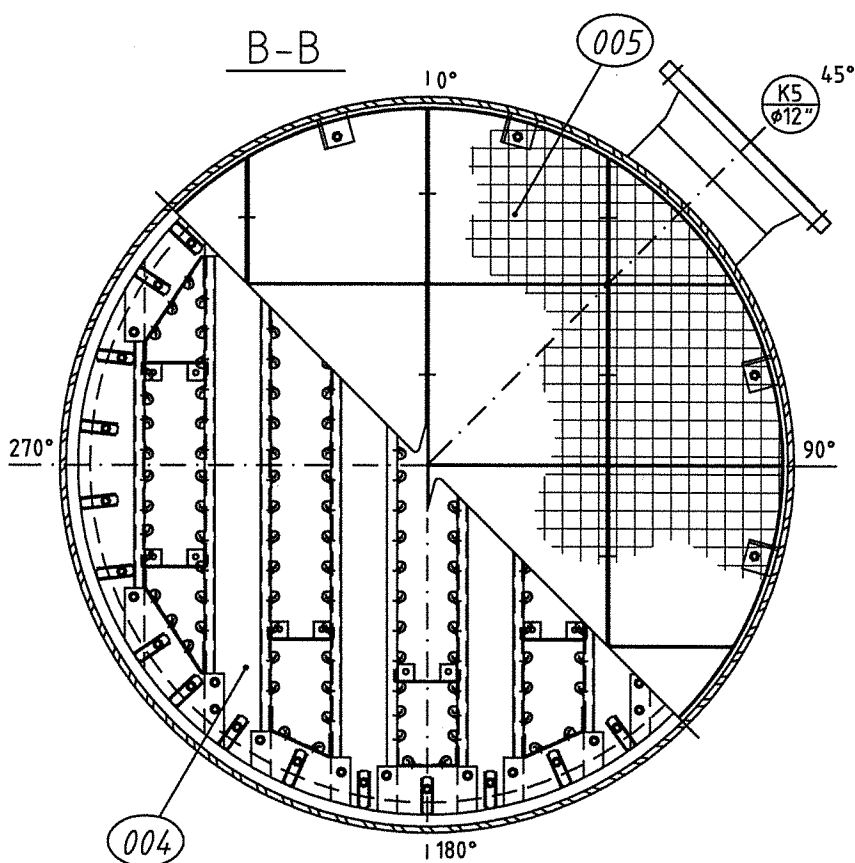
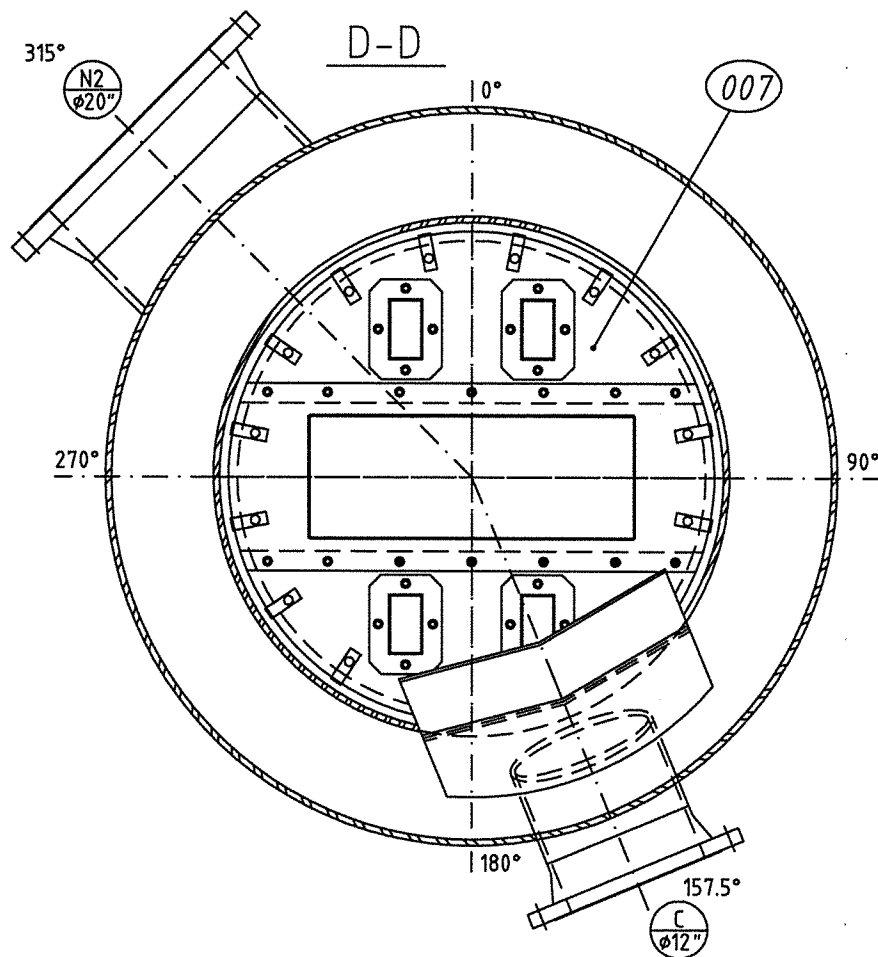
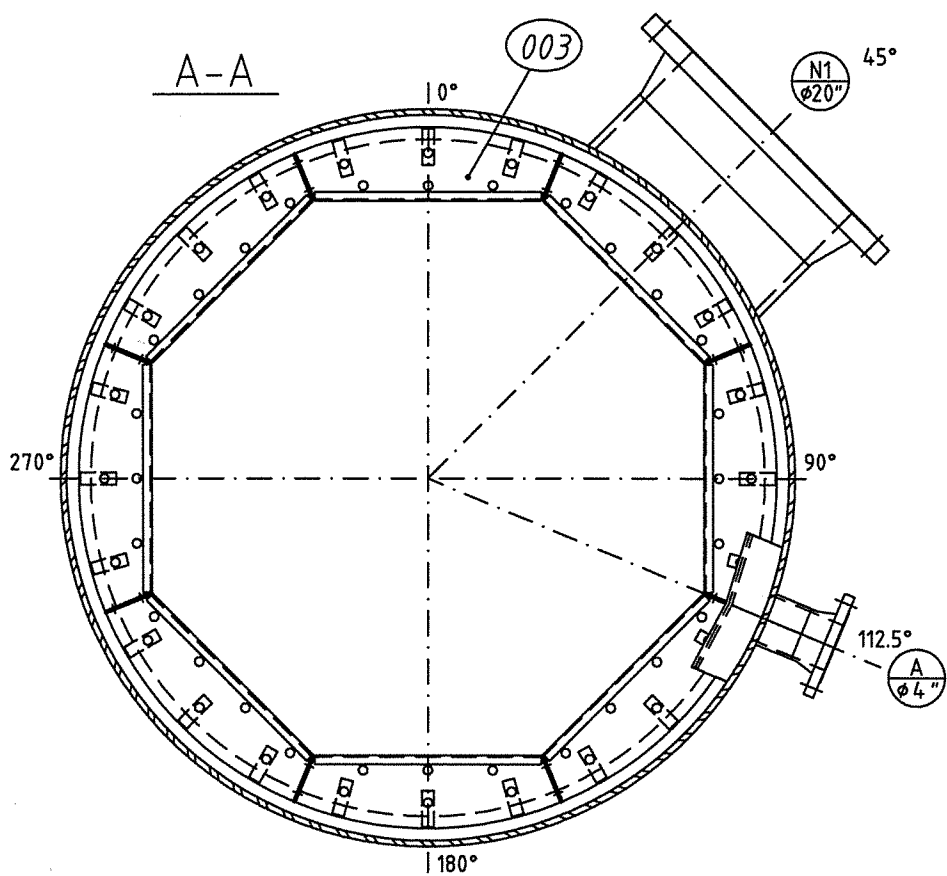
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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: N/A		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col ID: 60.0" / 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer dwg:			
bed: No.1 thru No.4		area:		ACAD 2002			

SULZER

GENERAL ARRANGEMENT
DEMETHANIZER TOWER

drawing no.:	sheet no.:
9033982-02	01

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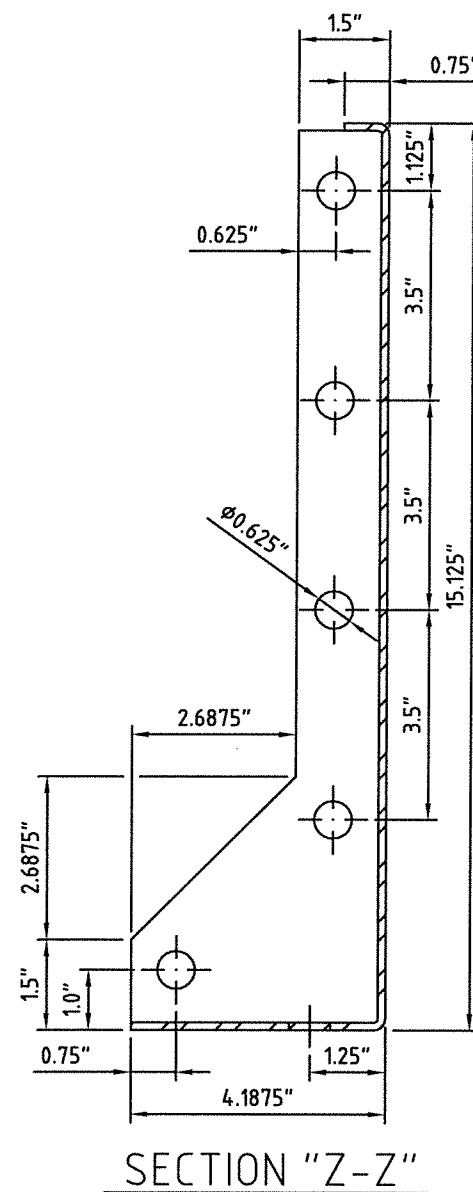
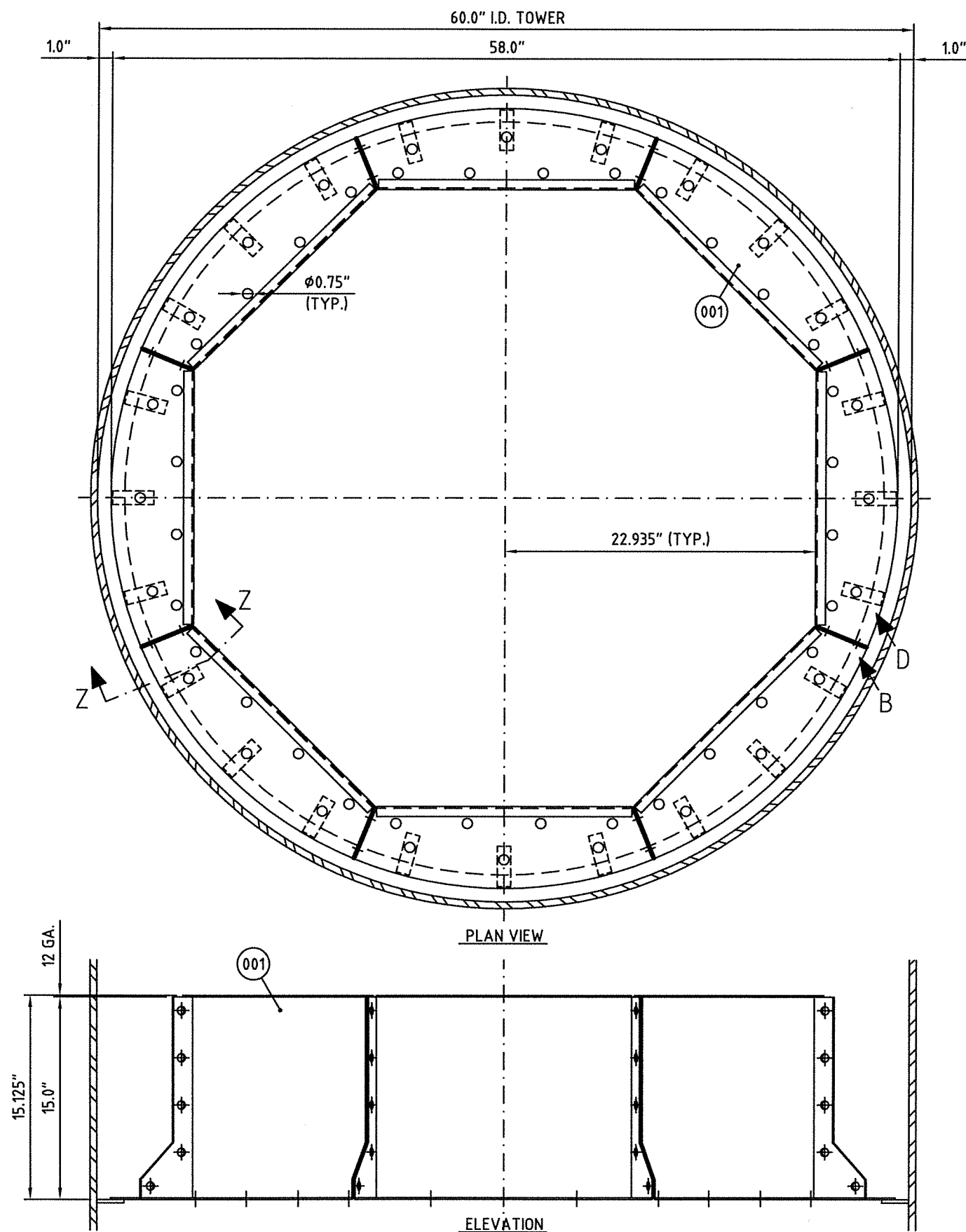


THIS DRAWING IS TO BE READ IN
CONJUNCTION WITH SHEET No.01.

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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	N/A	SULZER project no.:	9033982-02	size:	11x17	scale:	%
col ID:	60.0" / 42.0"	customer:	UOP RUSSELL LLC.	customer p.o.:	4500753897		
col item:	T-501	plant:		customer dwg.:			
bed:	No.1 and No.2	area:	ACAD 2002				
SULZER		ORIENTATIONS				drawing no.:	sheet no.:
		DEMETHANIZER TOWER (BEDS No.1 & 2)				9033982-02	02

state:
CERTIFIED

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item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. (lb.)
000	1	-	set		SKG GALLERY TRAY	BED No.1	304L	126
001	8	-	pcs.		SKG SEGMENT		304L	
002	40	4	pcs.		HEX HEAD CAPSCREW - 3/8"-16 UNC x 1 1/4" LONG		304L	0.0485
003	104	10	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
004	24	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
005	24	2	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
006	88	9	pcs.		NUT - 3/8"-16 UNC HEX		304L	0.0160
100	25.4	-	ft2		SHEET - 12 GA.		304L	4.427

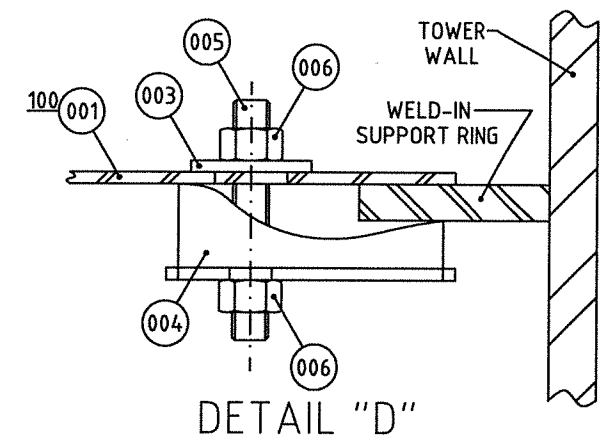
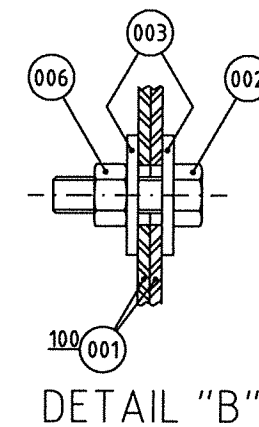
001 - 099: parts / 100 - 199: materials

Gallery Tray Data

DN Inlet Tube 4.0 / 101.6 [in] / [mm]
W/Feed Baffle
Number of Inlet Pipes 1 [-]
Number of Orifices 32 [-]
Orifice size: 0.75 / 19.05 [in] / [mm]

Flow Rates:

	Flow [gpm] / [m3/h]	levels above orifice [in] / [mm]
min.	13.7/3.1	0.03/1
max.	186.6/42.3	6.9/175



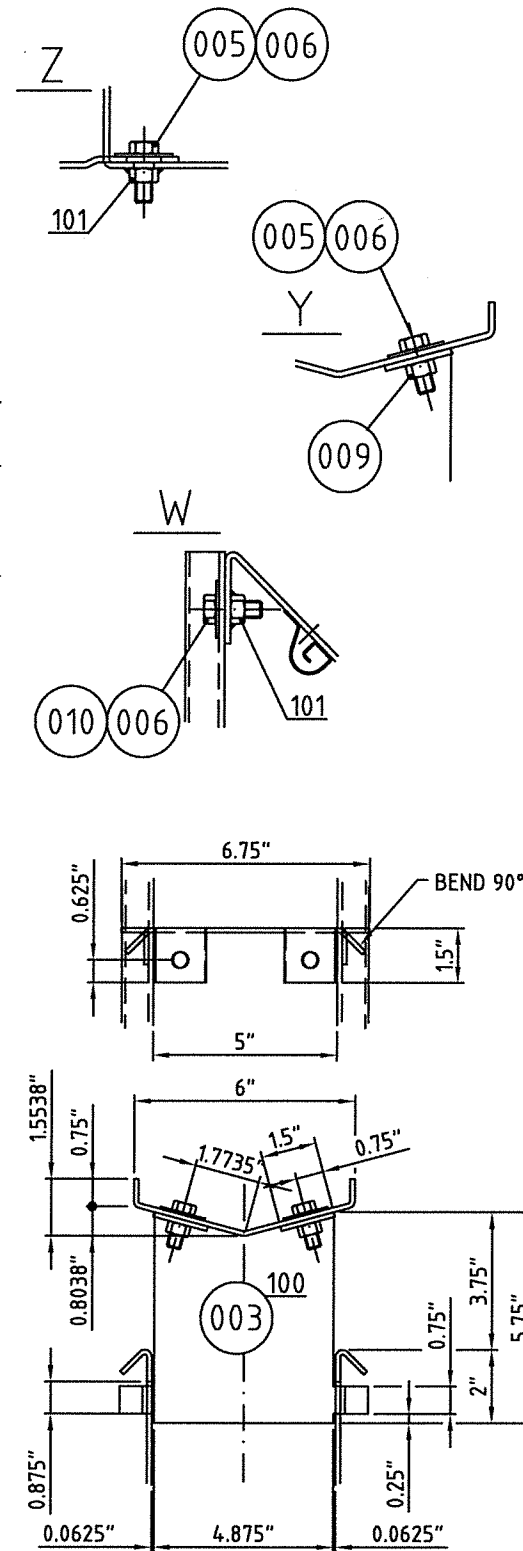
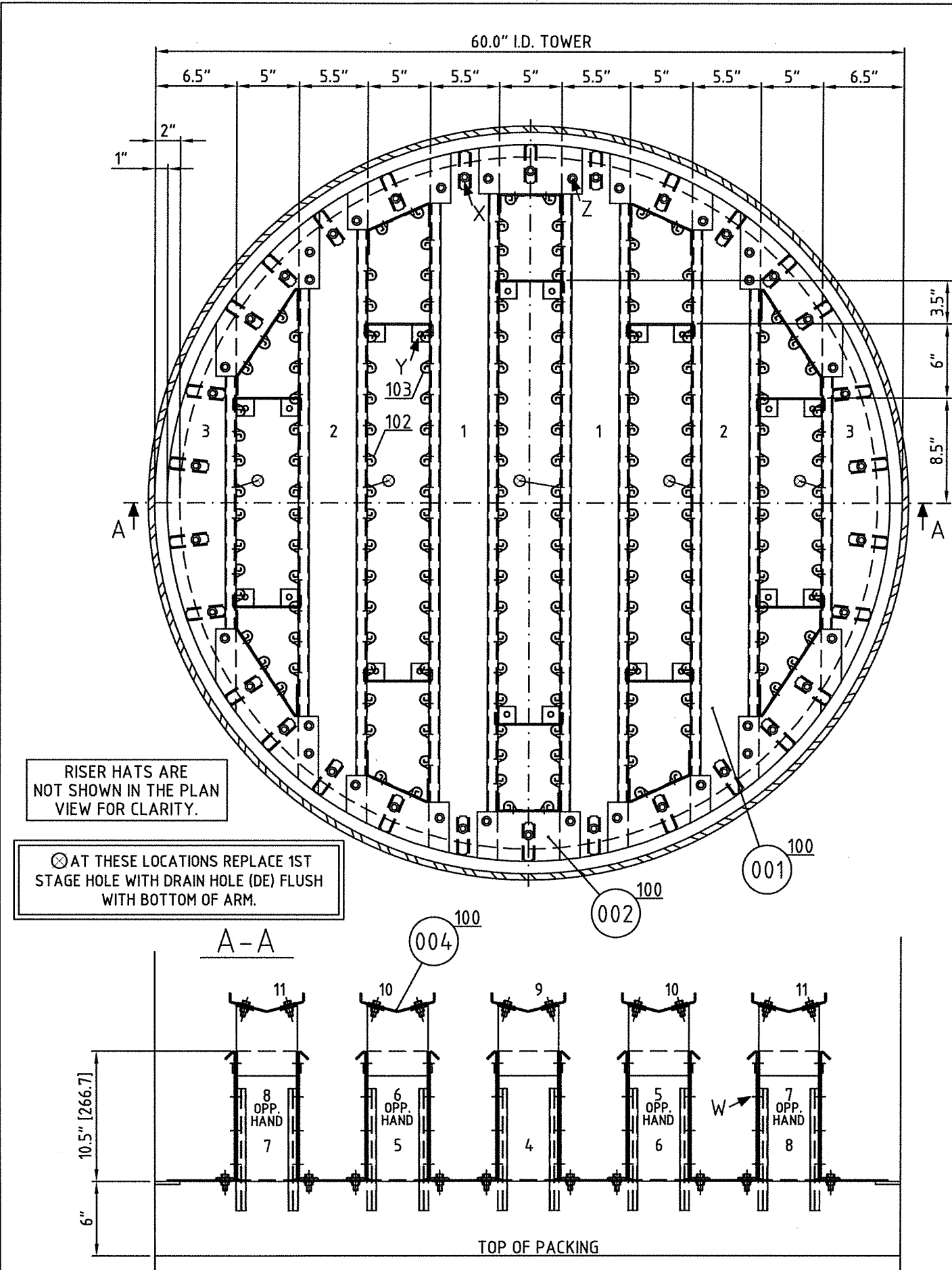
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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	-205	SULZER project no.: 9033982-02			size: 11x17	scale: %	
col.-I.D.:	60.0"	customer: UOP RUSSELL LLC.	customer p.o.: 4500753897				
col item:	T-501	plant:	customer-dwg.:				
bed:	No.1	area:	ACAD 2002				
SULZER		SKG GALLERY TRAY			drawing no.: sheet no.:		
		DEMETHANIZER TOWER (BED No.1)			9033982-02 03		
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GENERAL NOTES

All parts shall pass through man ways: 17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

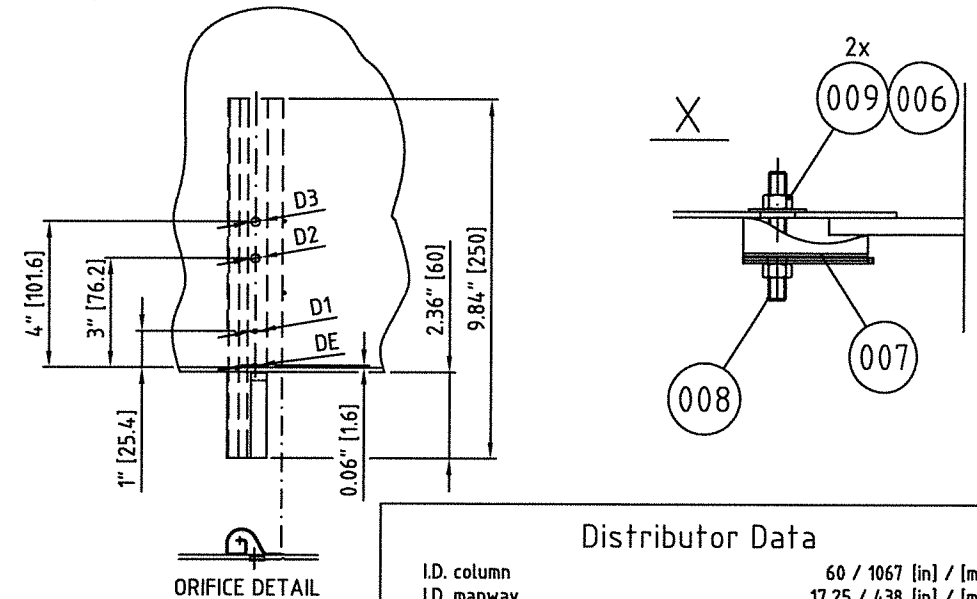
state:

CERTIFIED



item	qty	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb]
000	1	-	set		VSIR DISTRIBUTOR	BED No.1	304L / 316L	400
001	6	-	pcs.		ARM CHANNELS	2 x No. 1-3	304L / 316L	
002	10	-	pcs.		END PANELS	2 x No. 4-8	304L / 316L	
003	10	-	pcs.		HAT BRACKET		304L	
004	5	-	pcs.		RISER HAT	1 x No. 9 / 2 x No. 10-11	304L	
005	44	4	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
006	154	15	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
007	30	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
008	30	3	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
009	80	8	pcs.		NUT - 3/8"-16 UNC HEX		304L	0.0160
010	80	8	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 3/4" LONG		304L	0.0355
100	68	-	ft2		SHEET - 12 GA.		304L	4.427
101	104	-	pcs.		NUT - 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314
102	86	-	pcs.		CURL TUBE - LEFT	L = 9.8425" [250mm]	316L	0.4500
103	86	-	pcs.		CURL TUBE - RIGHT	L = 9.8425" [250mm]	316L	0.4500

001 - 099: parts / 100 - 199: materials



Distributor Data			
I.D. column	60 / 1067 [in] / [mm]		
I.D. manway	17.25 / 438 [in] / [mm]		
Number of drip points	172 [-]		
Distribution density	7.4 / 80 [1/ft ²] / [1/m ²]		
Orifice size: D3	0.236 / 6.0 [in] / [mm]		
Orifice size: D2	0.236 / 6.0 [in] / [mm]		
Orifice size: D1	0.110 / 2.8 [in] / [mm]		
Drain size: DE	0.098 / 2.5 [in] / [mm]		
CASE	Flow [gpm] / [m ³ /h]	Load [gpm/ft ²] / [m ³ /m ² h]	levels above orifice [in] / [mm]
Min.	13.7/3.1	0.70/1.70	1.77/45
Max.	186.6/42.4	9.50/23.24	7.44/189

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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -204		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col ID: 60.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.1		area:		ACAD 2002			
SULZER		VSIR DISTRIBUTOR			drawing no.: sheet no.:		
		DEMETHANIZER TOWER (BED No.1)			9033982-02 04		
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GENERAL NOTES

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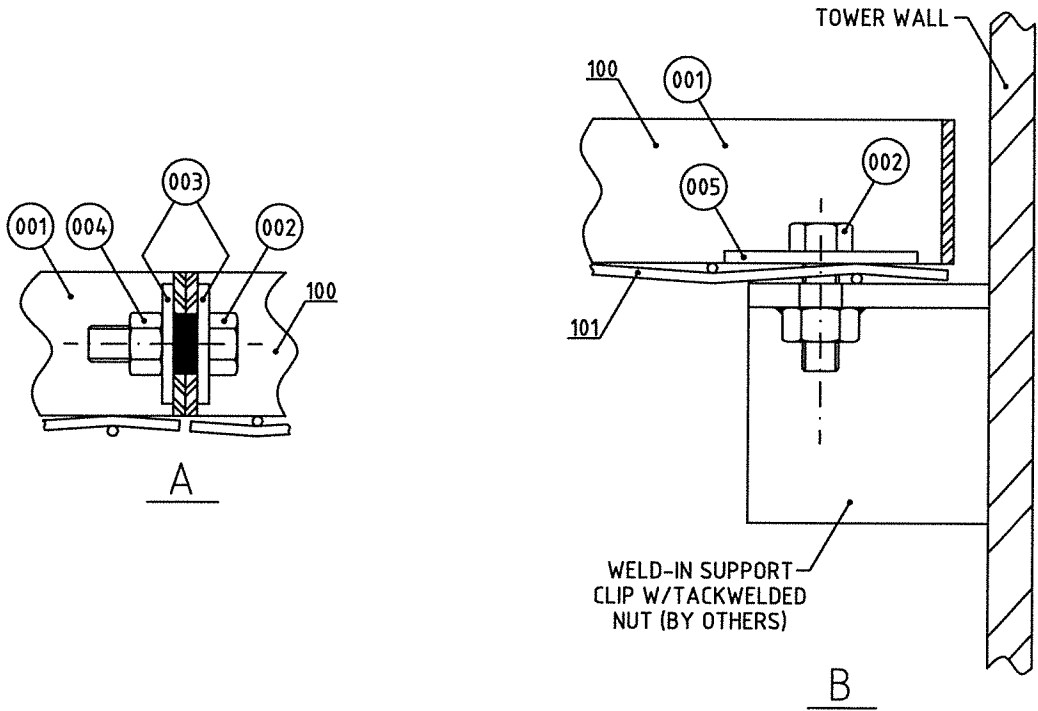
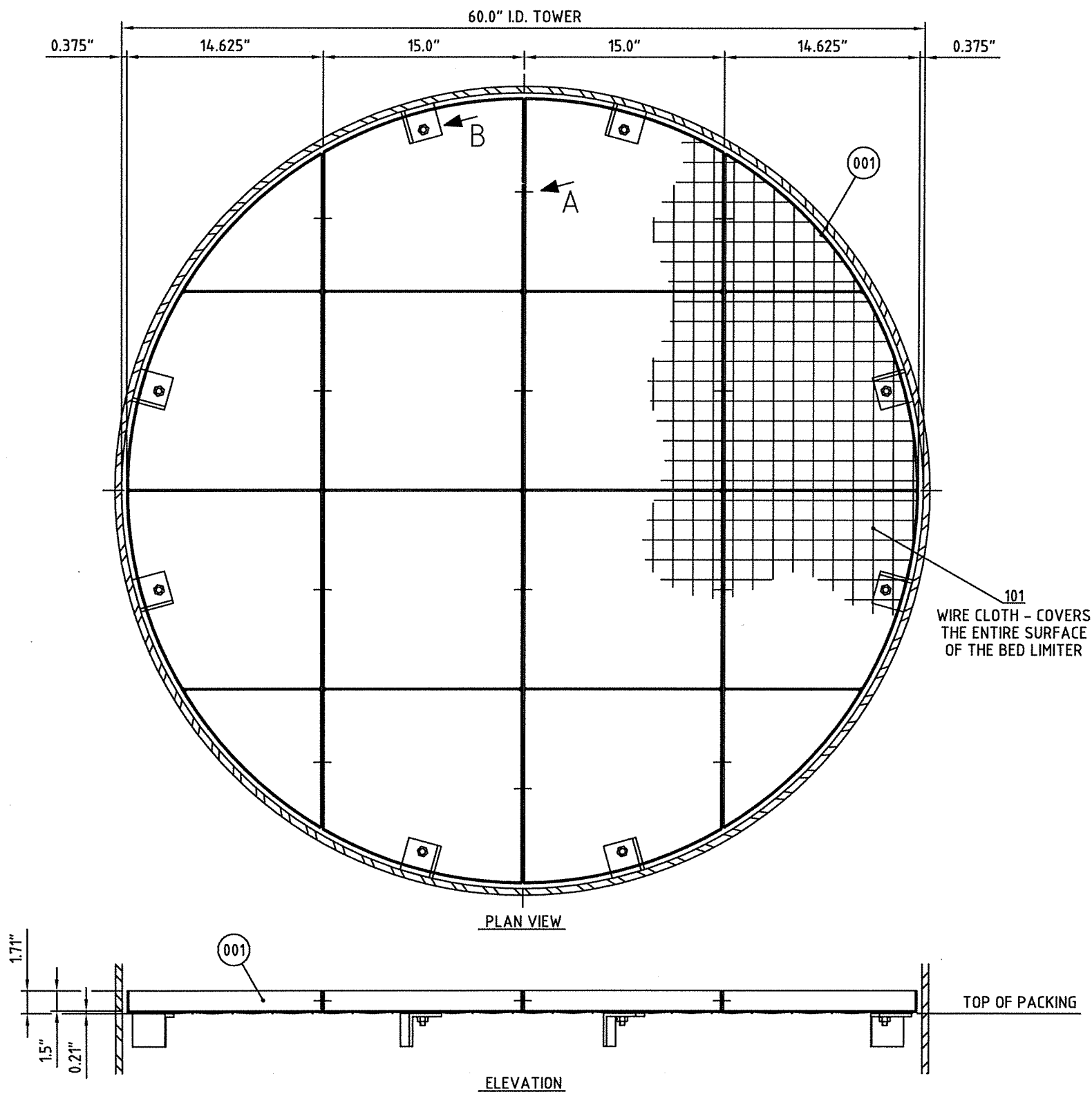
The assembled part is checked after manufact.

state:

CERTIFIED

item list									
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. (lb.)	
000	1	-	set		RPB BED LIMITER	BED No.1	304L / 316L	42	
001	4	-	pcs.		RPB BED LIMITER PANEL		304L / 316L		
002	20	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485	
003	24	3	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331	
004	12	2	pcs.		NUT - 3/8"-16 HEX		304L	0.0160	
005	8	2	pcs.		WASHER - 7/16" I.D. x 2" O.D.		304L	0.0920	
100	6.95	-	ft2		SHEET - 12 GA.		304L	4.427	
101	19.2	-	ft2		WIRE CLOTH- 0.75" x 0.75" x 0.08" ϕ		316L	0.4039	

001 - 099: parts / 100 - 199: materials

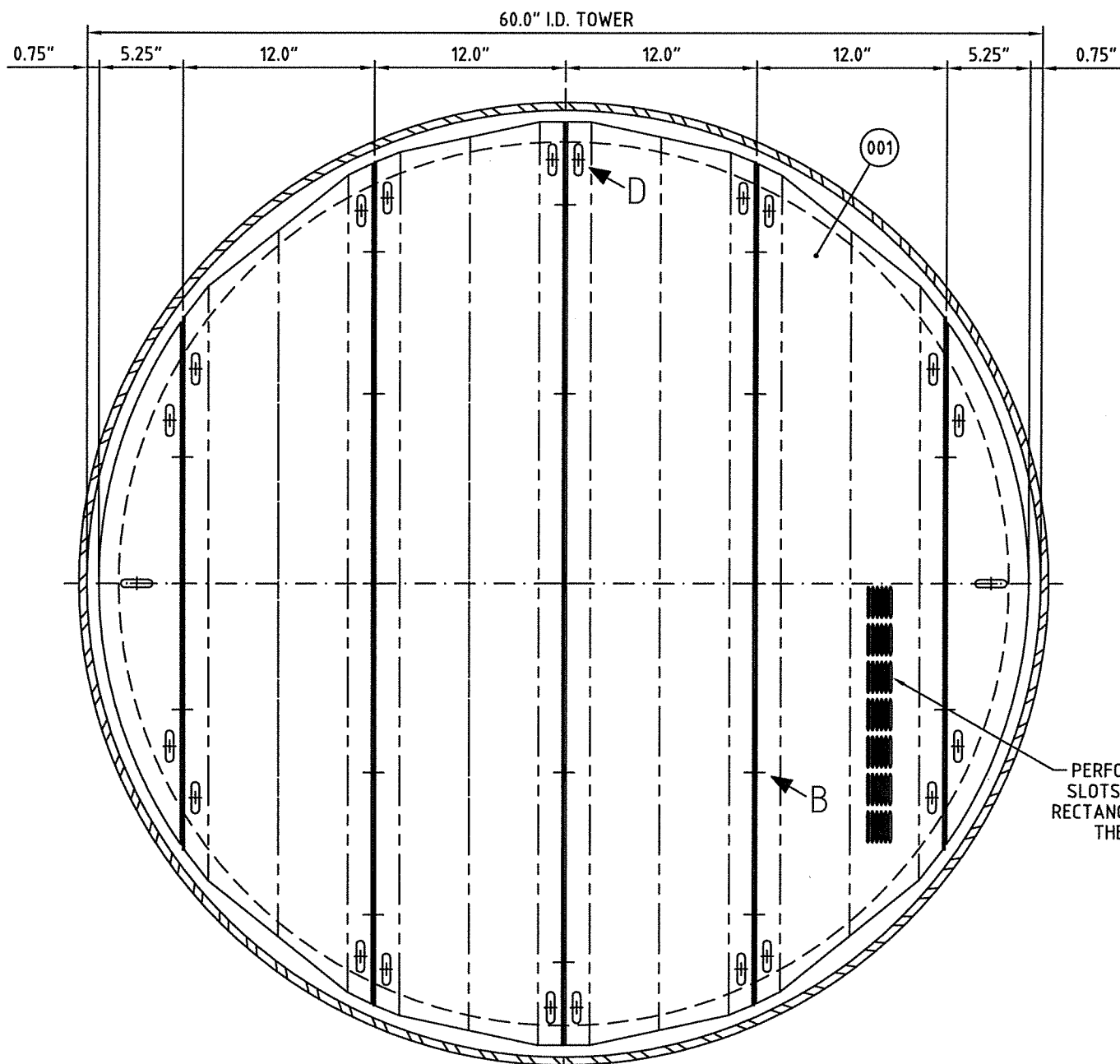


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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -207		SULZER project no.: 9033982-02				size: 11x17	scale: %
col I.D.: 60.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.1		area:		ACAD 2002			
SULZER		RPB BED LIMITER				drawing no.: sheet no.:	
		DEMETHANIZER TOWER (BED No.1)				9033982-02 05	
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GENERAL NOTES

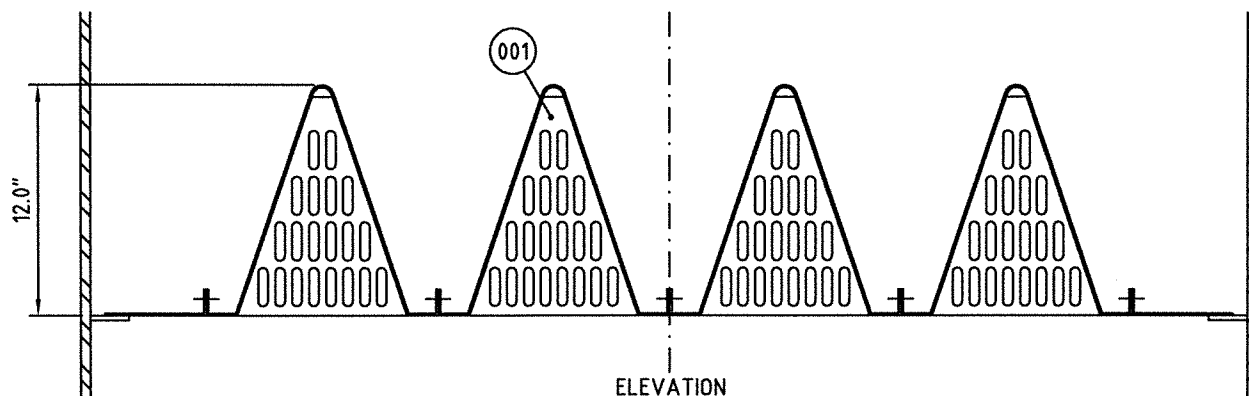
All parts shall pass through man ways:17.25" I.D.
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PERFORATIONS: 0.5" x 2.0"
SLOTS ON A 0.875" x 2.375"
RECTANGULAR PITCH COVERING
THE ENTIRE SURFACE

PLAN VIEW

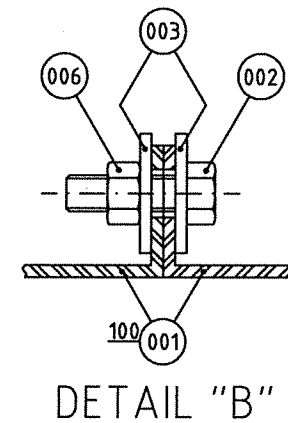


BOTTOM OF PACKING

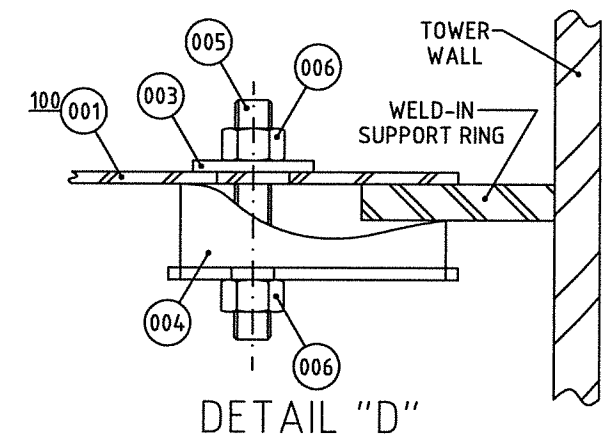
ELEVATION

item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		GIS SUPPORT PLATE	BED No.1	304L	225
001	6	-	pcs.		GIS SUPPORT PLATE PANEL		304L	
002	21	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
003	64	6	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
004	22	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
005	22	2	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
006	65	7	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
100	48.5	-	ft2		SHEET - 12 GA.		304L	4.427

001 - 099: parts / 100 - 199: materials



DETAIL "B"



DETAIL "D"

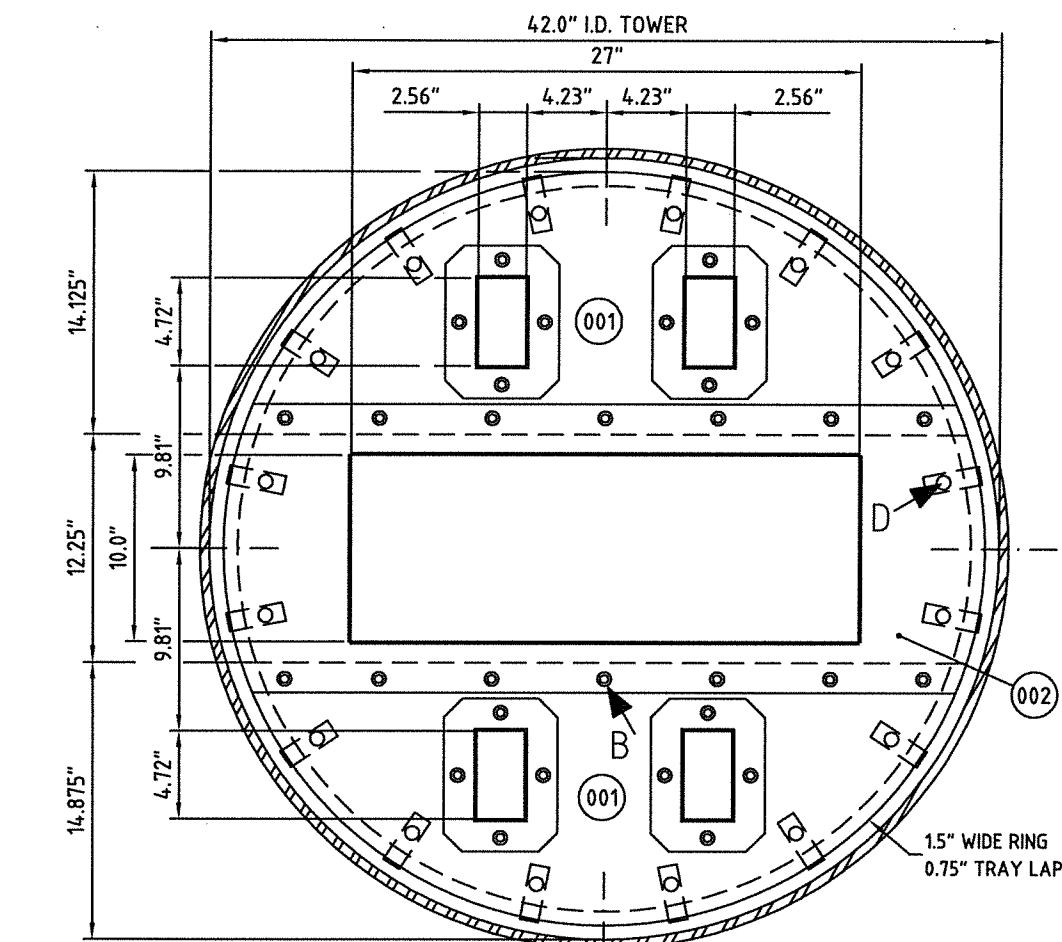
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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -206		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col.-I.D.: 60.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.1		area:		ACAD 2002			
SULZER		GIS SUPPORT PLATE DEMETHANIZER TOWER (BED No.1)			drawing no.: sheet no.:		
					9033982-02 06		
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GENERAL NOTES

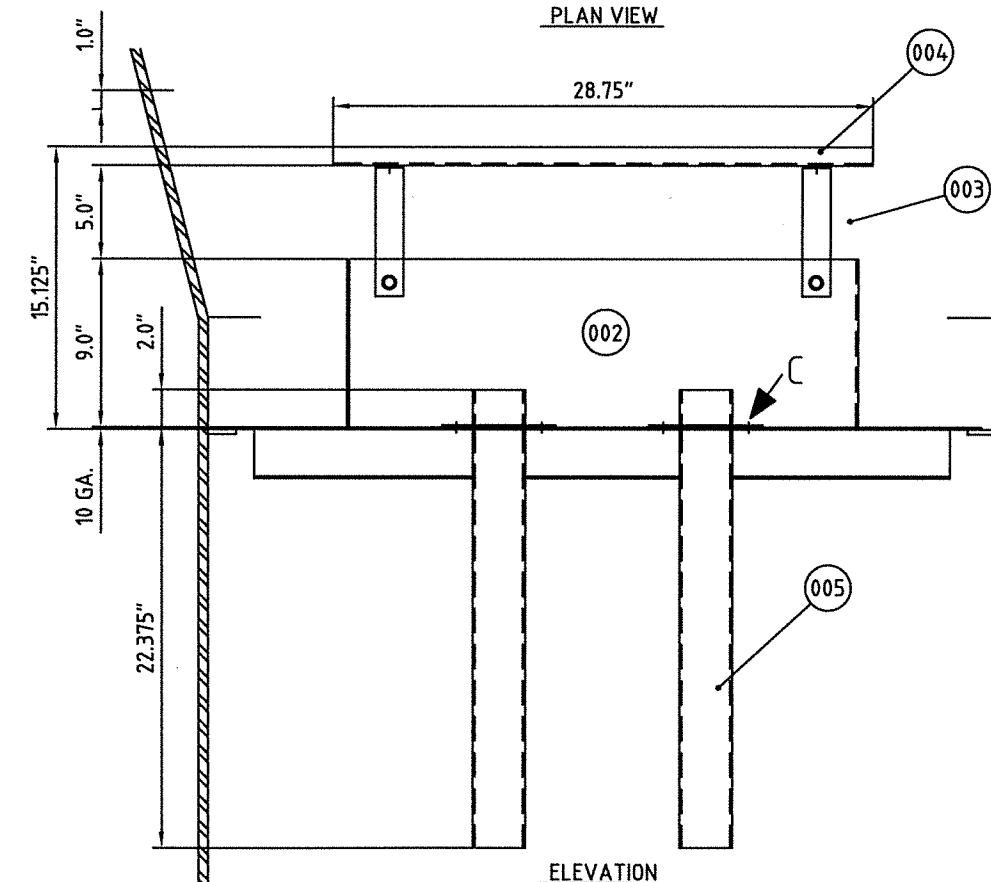
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state:

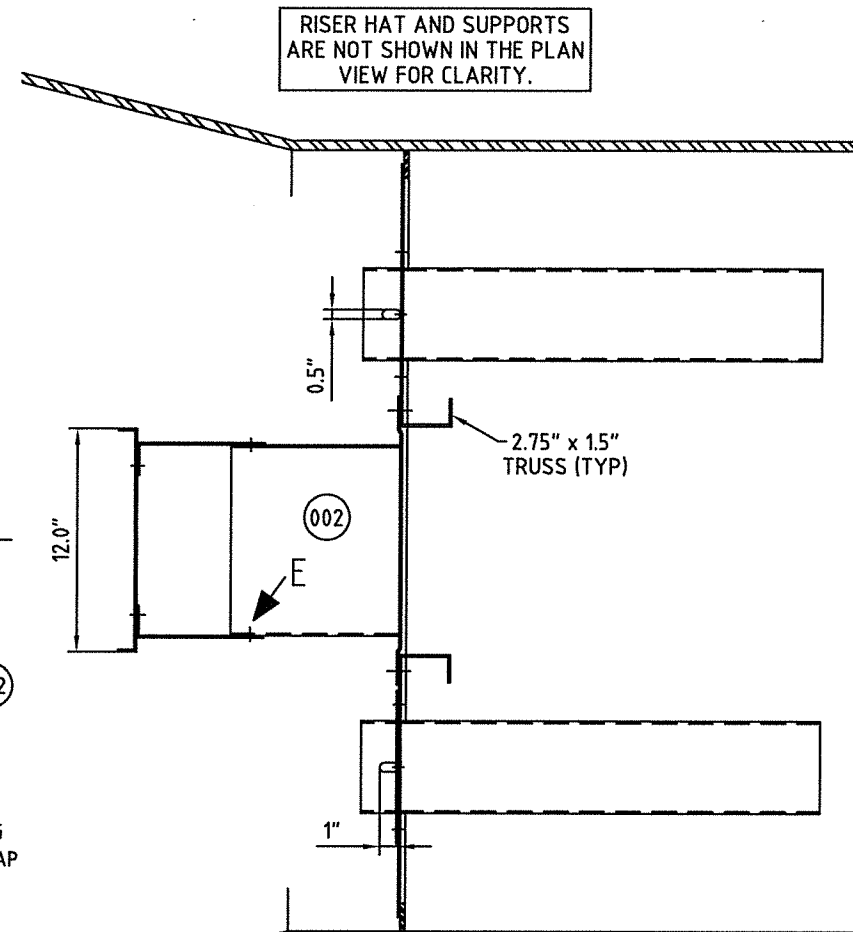
CERTIFIED



PLAN VIEW



ELEVATION

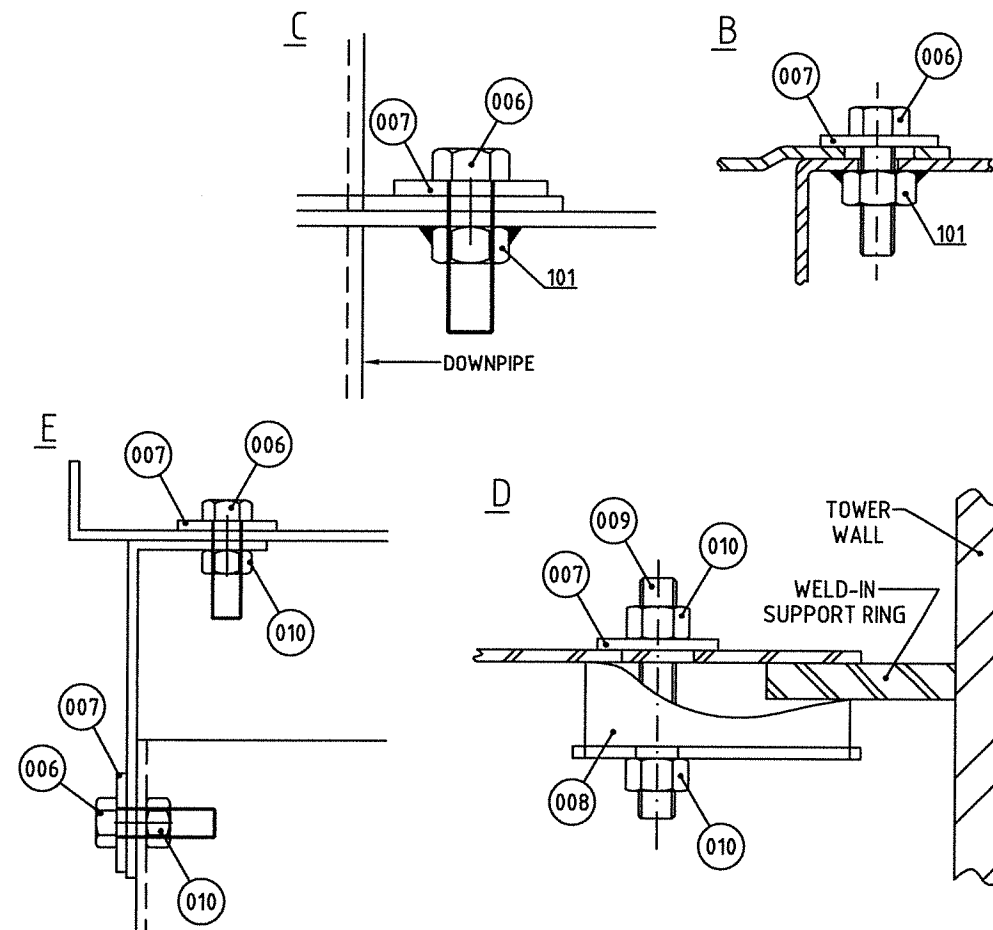


item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. (lb.)
000	1	-	set		SKH COLLECTOR TRAY	BED No.2	304L	153.5
001	2	-	pcs.		SKH COLLECTOR TRAY PANEL		304L	
002	1	-	pcs.		SKH COLLECTOR TRAY PANEL WITH RISER		304L	
003	4	-	pcs.		HAT SUPPORT		304L	
004	1	-	pcs.		RISER HAT		304L	
005	4	-	pcs.		DOWNPIPE WITH PLATE FLANGE		304L	
006	38	4	pcs.		HEX HEAD CAPSCREW - 3/8"-16 UNC x 1 1/4" LONG		304L	0.0485
007	54	5	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
008	16	2	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
009	16	2	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
010	40	4	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
100	27	-	ft2		SHEET - 10 GA.		304L	5.670
101	30	-	pcs.		NUT - 3/8"-16 HEAVY HEX TACKWELDED		304L	0.0314

001 - 099: parts / 100 - 199: materials

NOTE: MATERIAL FOR ALL PARTS TO BE 10GA.(MK. 100) EXCEPT AS NOTED.

ELEVATION



GENERAL NOTES

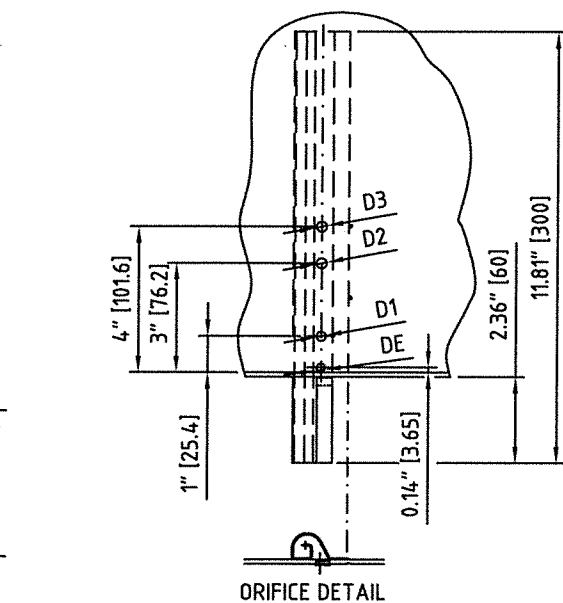
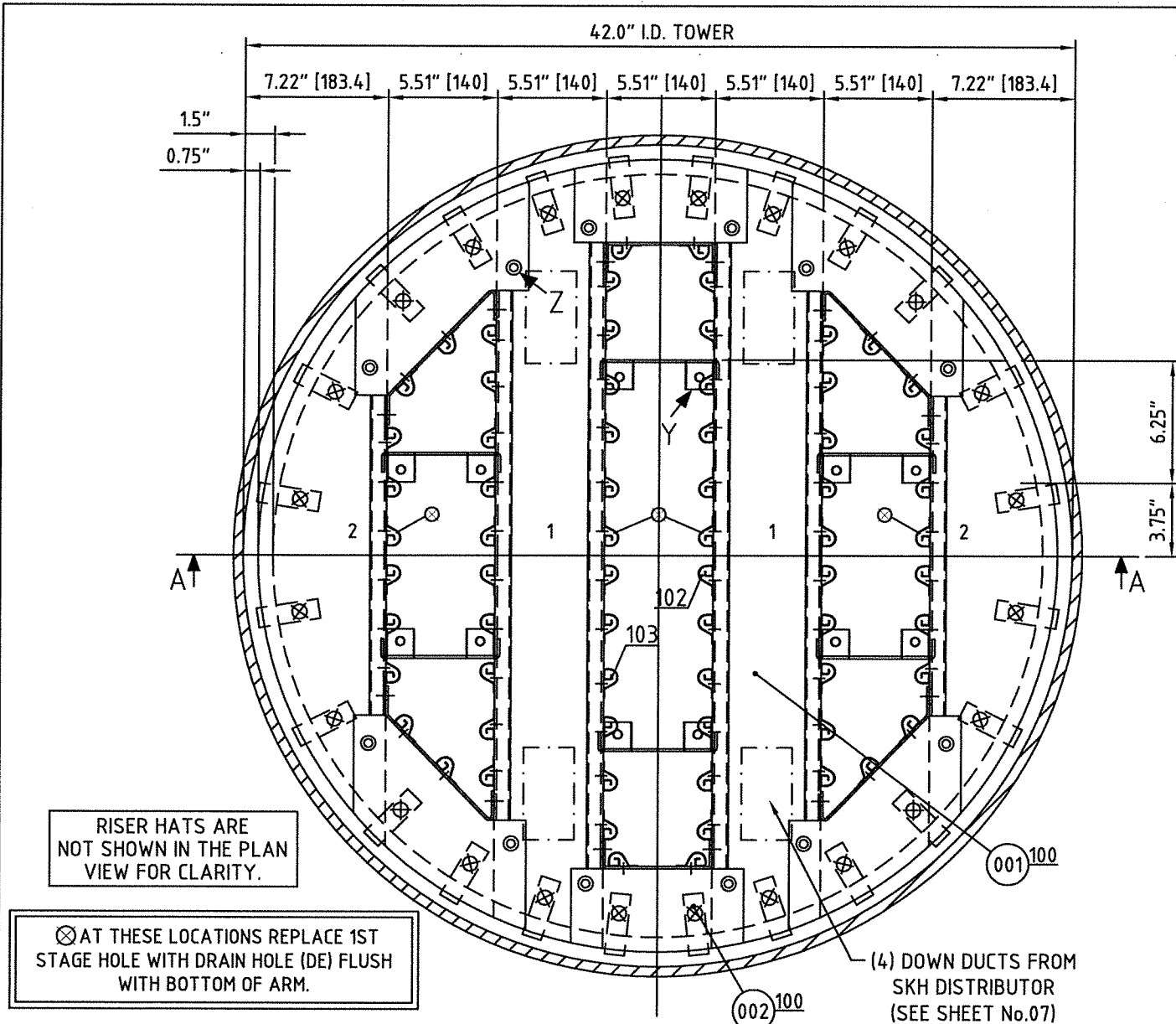
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The assembled part is checked after manufact.

state:

CERTIFIED

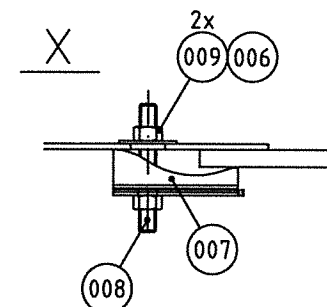
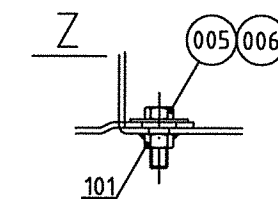
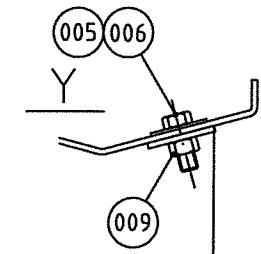
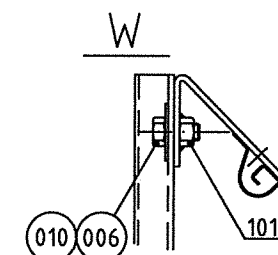
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0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	-210	SULZER project no.:	9033982-02	size:	11x17	scale:	%
col.-I.D.:	42.0"	customer:	UOP RUSSELL LLC.	customer p.o.:	4500753897		
col item:	T-501	plant:		customer-dwg.:			
bed:	No.2	area:		ACAD 2002			
SULZER		SKH COLLECTOR TRAY DEMETHANIZER TOWER (BED No.2)				drawing no.:	sheet no.:
						9033982-02	07

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item	qty	spare	unit	drawing- or part-no.	description	remarks	material	wght. (lb)
000	1	-	set		VSIR DISTRIBUTOR	BED No.2	304L / 316L	187
001	4	-	pcs.		ARM CHANNELS	2 x No.1-2	304L / 316L	
002	6	-	pcs.		END PANELS	2 x No.3-5	304L / 316L	
003	6	-	pcs.		HAT BRACKET		304L	
004	3	-	pcs.		RISER HAT	1 x No.6 / 2 x No.7	304L	
005	24	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
006	108	11	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
007	24	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
008	24	3	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
009	60	6	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
010	60	6	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 3/4" LONG		304L	0.0355
100	32	-	ft2		SHEET - 12 GA.		304L	4.427
101	72	-	pcs.		NUT - 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314
102	34	-	pcs.		CURL TUBE - LEFT	L = 11.81" [300mm]	316L	0.5250
103	34	-	pcs.		CURL TUBE - RIGHT	L = 11.81" [300mm]	316L	0.5250

001 - 099: parts / 100 - 199: materials



Distributor Data			
I.D. column	42 / 1067 [in] / [mm]		
I.D. manway	17.25 / 438 [in] / [mm]		
Number of drip points	68 [-]		
Distribution density	7.4 / 80 [1/ft2] / [1/m2]		
Orifice size: D3	0.284 / 7.2 [in] / [mm]		
Orifice size: D2	0.284 / 7.2 [in] / [mm]		
Orifice size: D1	0.260 / 6.6 [in] / [mm]		
Drain size: DE	0.236 / 6.0 [in] / [mm]		
CASE	Flow [gpm] / [m3/h]	Load [gpm/ft2] / [m3/m2h]	levels above orifice [in] / [mm]
Min.	26.8/6.1	2.78/6.80	1.65/42
Max.	161.5/36.7	16.79/41.04	9.33/237

1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -208		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col ID: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg:			
bed: No.2		area:		ACAD 2002			
SULZER		VSIR DISTRIBUTOR			drawing no.: sheet no.:		
		DEMETHANIZER TOWER (BED No.2)			9033982-02 08		
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GENERAL NOTES

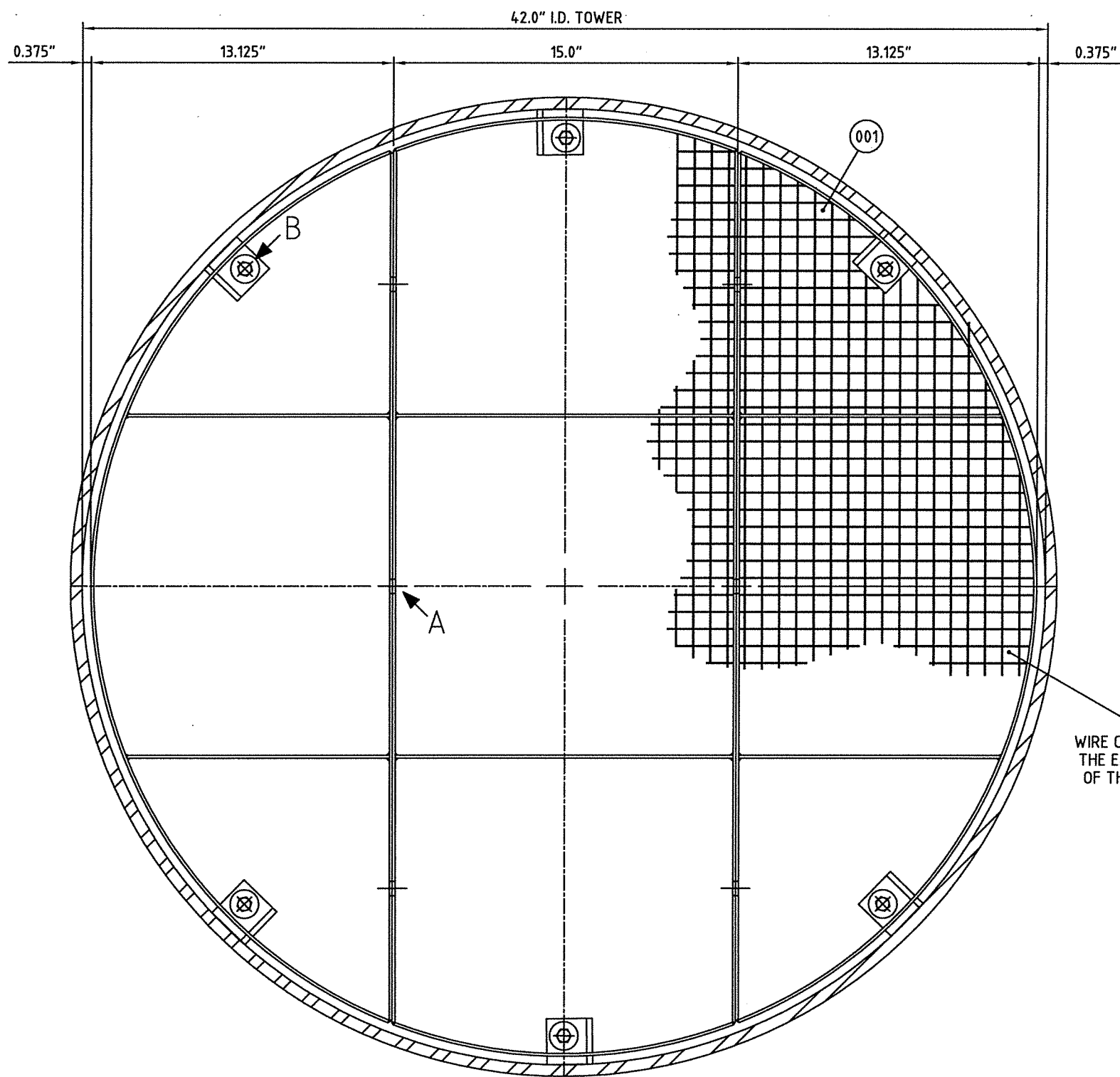
All parts shall pass through man ways: 17.25" I.D.

All components are marked by SULZER.

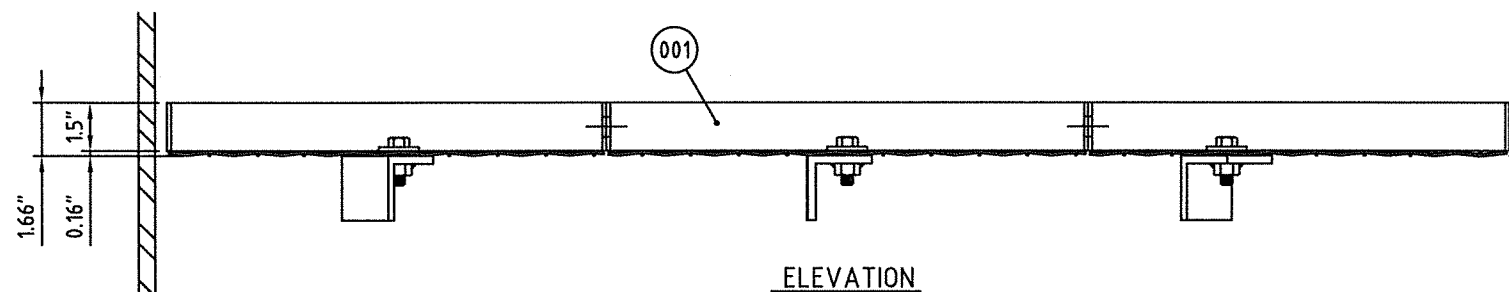
The assembled part is checked after manufact.

state:

CERTIFIED

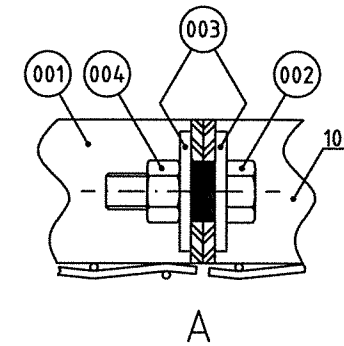


PLAN VIEW

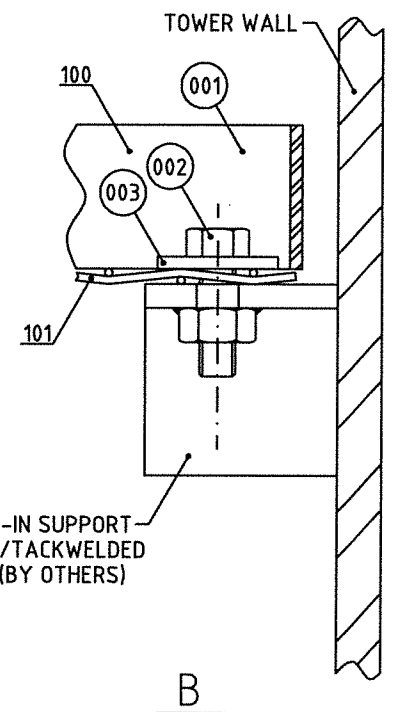


ELEVATION

101
WIRE CLOTH - COVERS
THE ENTIRE SURFACE
OF THE BED LIMITER



A



B

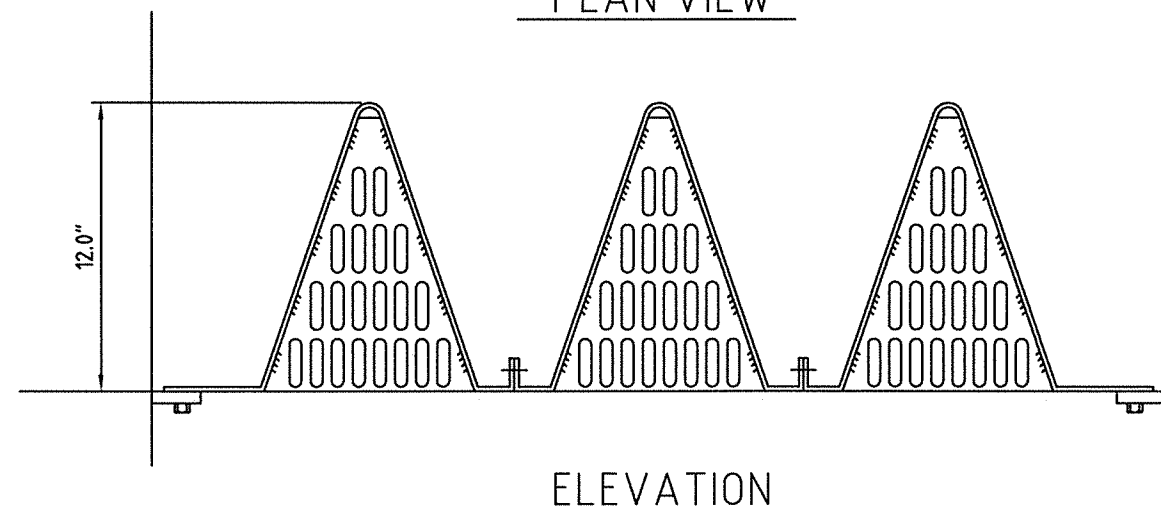
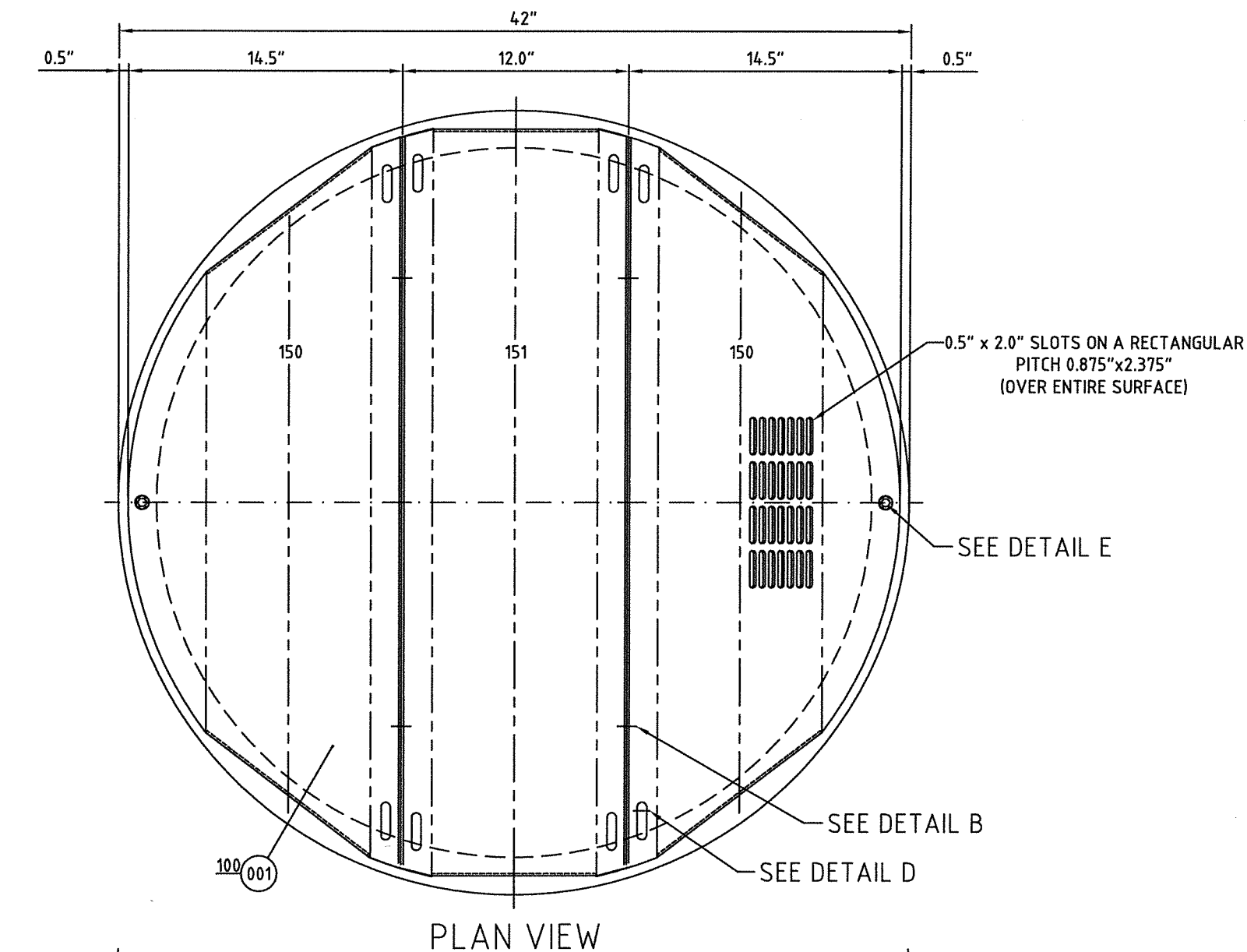
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. (lb.)
000	1	-	set		RPB BED LIMITER	BEDS No.2, 3, & 4	304L / 316L	50
001	3	-	pcs.		RPB BED LIMITER PANEL		304L / 316L	
002	12	2	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
003	18	3	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
004	6	2	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
100	6.95	-	ft2		SHEET - 12 GA.		304L	4.427
101	8	-	ft2		WIRE CLOTH- 0.75" x 0.75" x 0.080"φ		316L	0.5024

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) RPB BED LIMITER.
A QUANTITY OF 3 (THREE) RPB BED LIMITERS AS SHOWN ON THIS SHEET
ARE REQUIRED. ONE EACH FOR BEDS No.2, No.3, AND No.4.

GENERAL NOTES
All parts shall pass through man ways: 17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

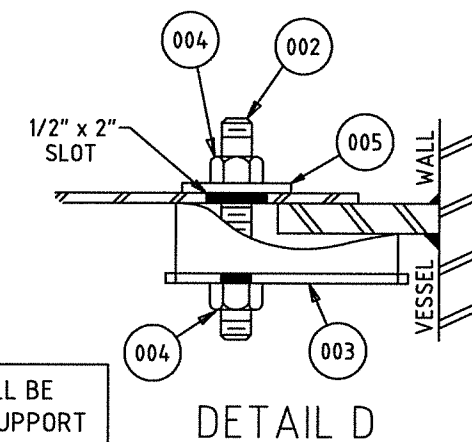
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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -214		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col I.D.: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.2, 3, & 4		area:		ACAD 2002			
SULZER		RPB BED LIMITER			drawing no.: sheet no.:		
		DEMETHANIZER TOWER (BEDS No.2, 3, & 4)			9033982-02 09		
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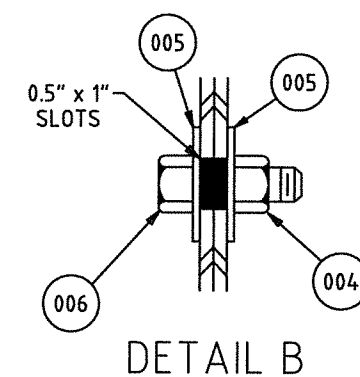
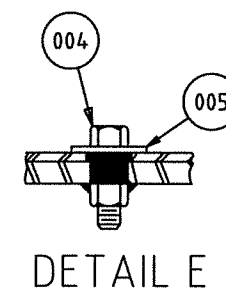
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. (lb)
000	1	-	set		GIS Support Plate		304L	112.4
001	3	-	pcs.	150 (2) & 151 (1)	GIS Panel		304L	
002	8	2	pcs.		Square Stud - 3/8"-16 x 2.5" Long (All Thread)		304L	0.0733
003	8	2	pcs.		Clamp - Universal - Two Way		304L	0.1250
004	22	3	pcs.		Hex Nut - 3/8"-16		304L	0.0160
005	22	2	pcs.		Washer - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
006	8	1	pcs.		Hex Head Capscrew - 3/8"-16 x 1 1/2" Long		304L	0.0565
100	24.5	-	ft2		Sheet - 12 Ga.		304L	4.4270

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) GIS SUPPORT PLATE. A QUANTITY OF 3 (THREE) GIS SUPPORT PLATES AS SHOWN ON THIS SHEET ARE REQUIRED. ONE EACH FOR BEDS No.1, No.3, AND No.4.



NOTE: SUPPORT PLATE PANEL SHALL BE TACK-WELDED TO WELD-IN SUPPORT RING DURING INSTALLATION (TYP).

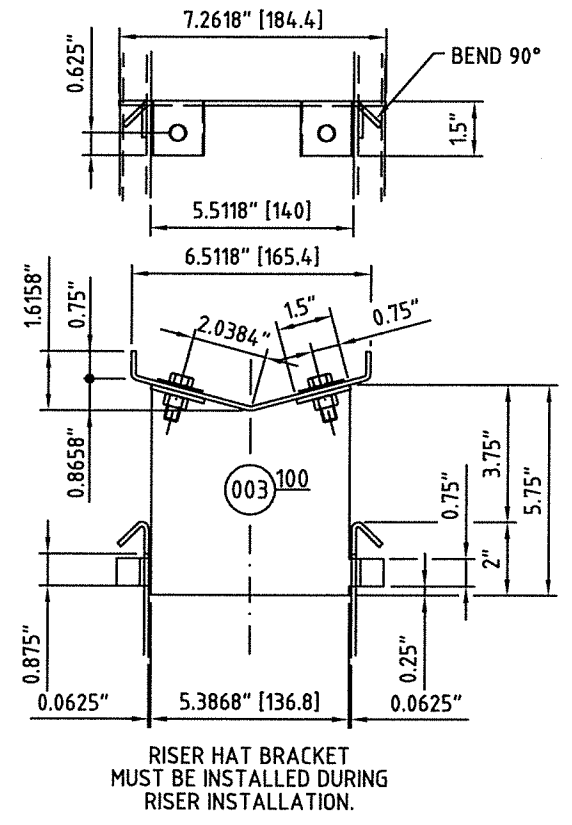
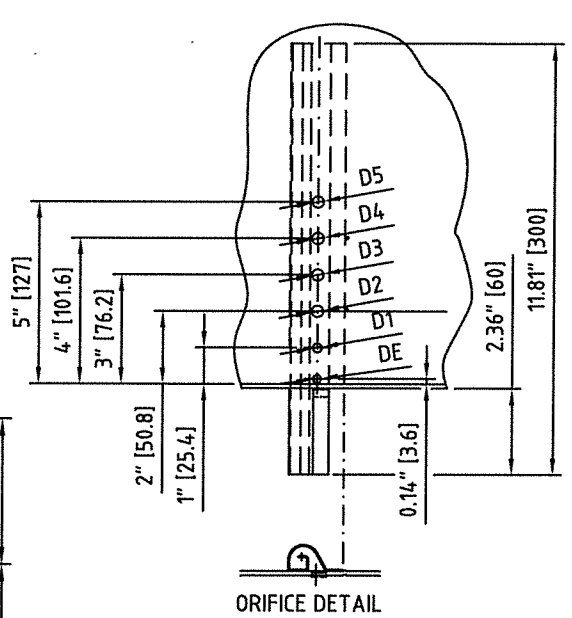
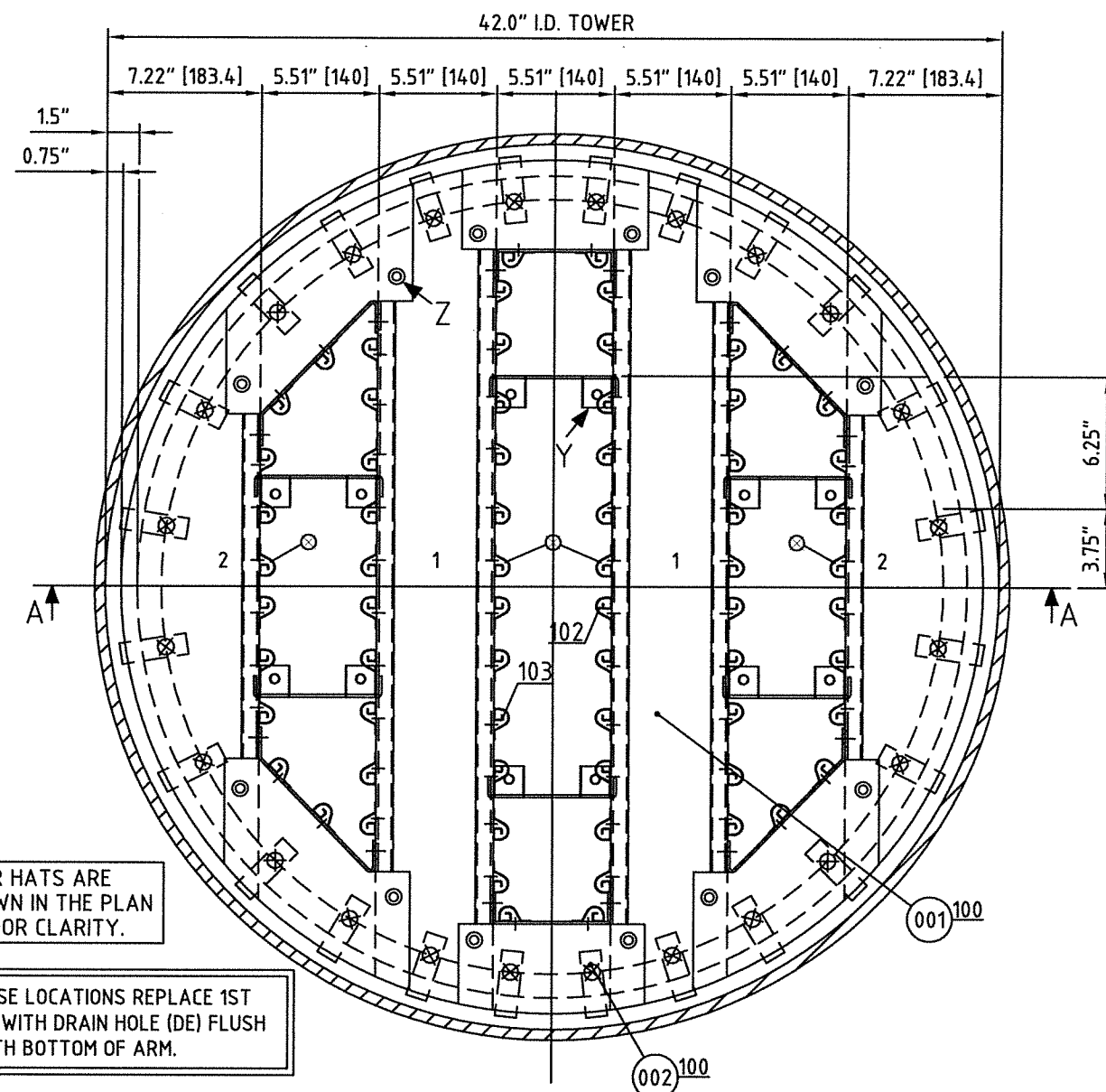


GENERAL NOTES
All parts shall pass through man ways 47.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state:
CERTIFIED

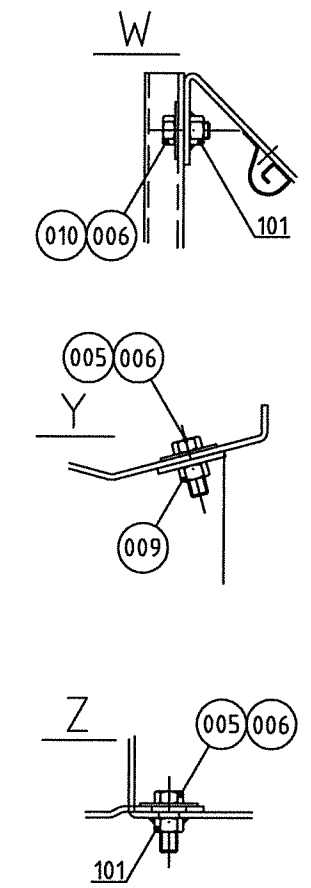
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rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	-213	SULZER project no.:	9033982-02	size:	11x17	scale:	%
col I.D.:	42"	customer:	UOP RUSSELL LLC.	customer p.o.:	4500753897		
col item:		plant:		customer-dwg.:			
bed:	No.1,3 & 4	process:		ACAD 2002			
	SULZER	GIS-SUPPORT PLATE		drawing no.:	sheet no.:		
		DEMETHANIZER TOWER		9033982-02	10		

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item	qty	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb]
000	1	-	set		VSIR DISTRIBUTOR	BED No.3	304L / 316L	187
001	4	-	pcs.		ARM CHANNELS	2 x No.1-2	304L / 316L	
002	6	-	pcs.		END PANELS	2 x No.3-5	304L / 316L	
003	6	-	pcs.		HAT BRACKET		304L	
004	3	-	pcs.		RISER HAT	1 x No.6 / 2 x No.7	304L	
005	24	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
006	108	11	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
007	24	3	pcs.		UNIVERSAL CLAMP - TWO WAY		304L	0.1900
008	24	3	pcs.		SQUARE STUD - 3/8"-16 x 2 1/2" LONG		304L	0.0610
009	60	6	pcs.		NUT - 3/8"-16 HEX		304L	0.0160
010	60	6	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 3/4" LONG		304L	0.0355
100	32	-	ft2		SHEET - 12 GA.		304L	4.427
101	72	-	pcs.		NUT - 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314
102	34	-	pcs.		CURL TUBE - LEFT	L = 11.81" [300mm]	316L	0.5250
103	34	-	pcs.		CURL TUBE - RIGHT	L = 11.81" [300mm]	316L	0.5250

001 - 099: parts / 100 - 199: materials



Distributor Data			
I.D. column	42 / 1067 [in] / [mm]		
I.D. manway	17.25 / 438 [in] / [mm]		
Number of drip points	68 [-]		
Distribution density	7.4 / 80 [1/ft2] / [1/m2]		
Orifice size: D5	0.3145 / 8 [in] / [mm]		
Orifice size: D4	0.3145 / 8 [in] / [mm]		
Orifice size: D3	0.3145 / 8 [in] / [mm]		
Orifice size: D2	0.3145 / 8 [in] / [mm]		
Orifice size: D1	0.252 / 6.4 [in] / [mm]		
Drain size: DE	0.228 / 5.8 [in] / [mm]		
CASE	Flow [gpm] / [m3/h]	Load [gpm/ft2] / [m3/m2h]	levels above orifice [in] / [mm]
Min.	49.9 / 11.3	5.19 / 12.68	1.65 / 42
Max.	319.4 / 72.5	33.19 / 81.15	9.45 / 240

1	CERTIFIED ISSUE	Tsa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -221		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col ID: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.3		area:		ACAD 2000			
SULZER		VSIR DISTRIBUTOR DEMETHANIZER TOWER (BED No.3)			drawing no.: sheet no.: 9033982-02 12		
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GENERAL NOTES

All parts shall pass through man ways: 17.25" I.D.

All components are marked by SULZER.

The assembled part is checked after manufact.

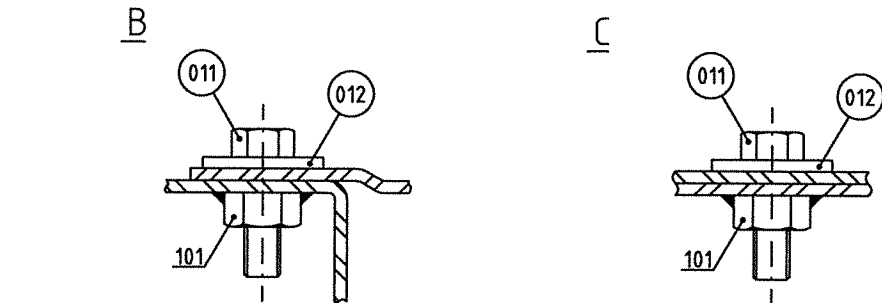
state:

CERTIFIED

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		SKHW COLLECTOR TRAY	BED No.3	304L	120
001	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
002	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
003	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
004	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
005	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
006	2	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
007	2	-	pcs.		RISER		304L	
008	4	-	pcs.		HAT SUPPORT		304L	
009	2	-	pcs.		HAT SUPPORT		304L	
010	2	-	pcs.		RISER HAT		304L	
011	32	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
012	32	3	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
100	21	-	ft2		SHEET - 10 GA.		304L	5.67
101	32	-	pcs.		NUT - 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314

001 - 099: parts / 100 - 199: materials

NOTE: MATERIAL FOR ALL PARTS TO BE 10GA.(MK. 100) EXCEPT AS NOTED.



NOTE TO TRAY INSTALLER
CHIMNEY TRAY FLOOR, RISER & DOWNCOMER
TO BE COMPLETELY SEAL WELDED DOWN ALL
SEAMS, AT ALL JOINTS & BOLTING TO
PROVIDE A LIQUID TIGHT TRAY.

RISER HATS ARE
NOT SHOWN IN THE PLAN
VIEW FOR CLARITY.

GENERAL NOTES

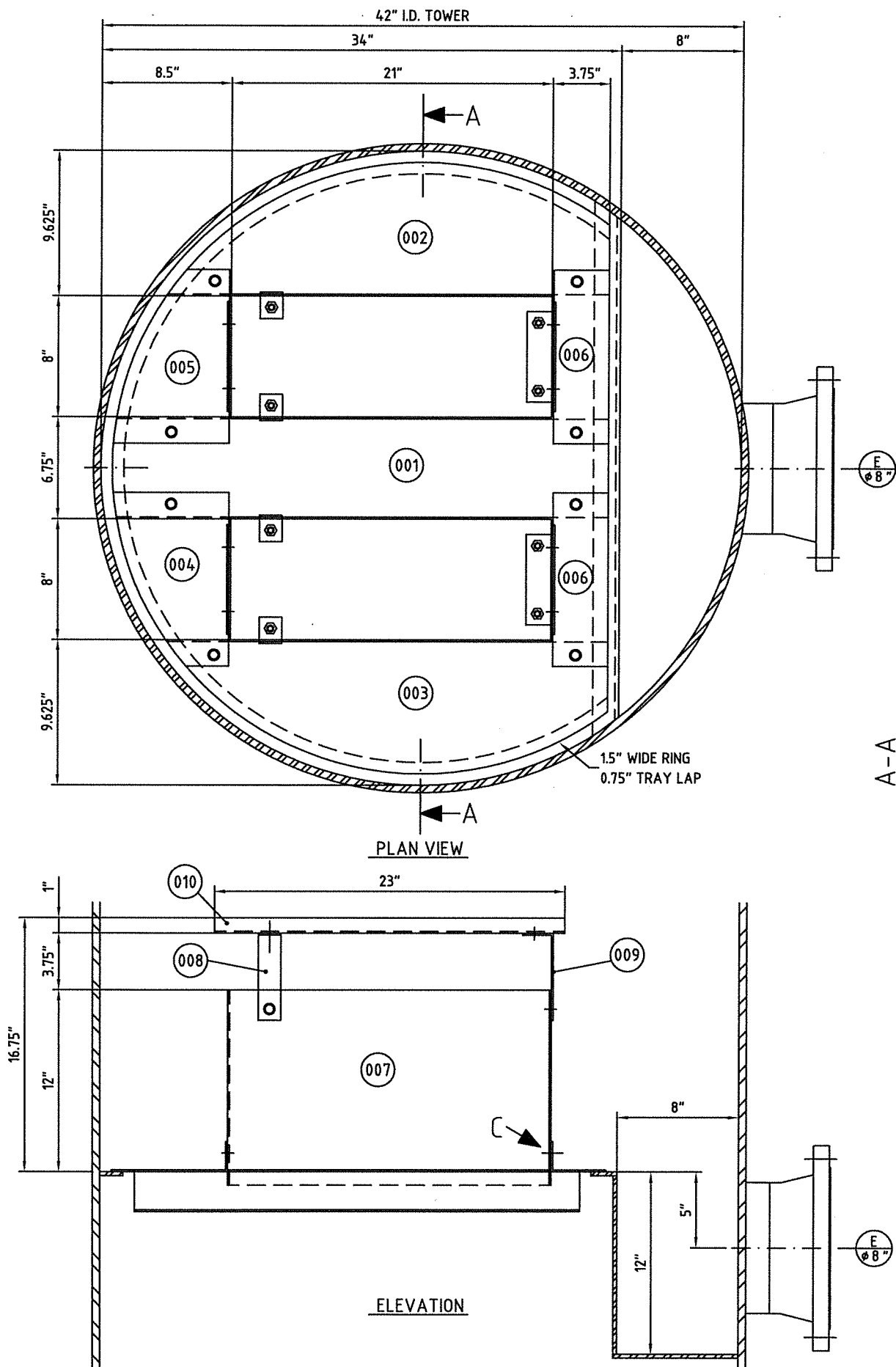
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

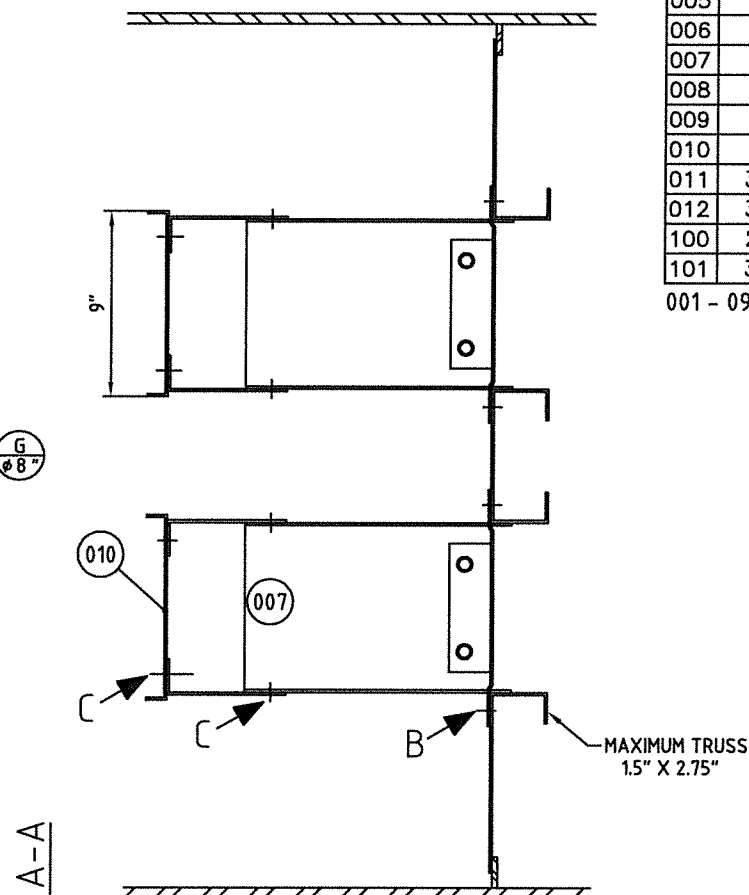
state:

CERTIFIED

1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWf	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWf	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	-212	SULZER project no.:	9033982-02	size:	11x17	scale:	%
col.-I.D.:	42.0"	customer:	UOP RUSSELL LLC.	customer p.o.:	4500753897		
col item:	T-501	plant:		customer-dwg.:			
bed:	No.3	area:	ACAD 2000				
SULZER		SKHW COLLECTOR TRAY			drawing no.:	sheet no.:	
		DEMETHANIZER TOWER (BED No.3)			9033982-02	13	

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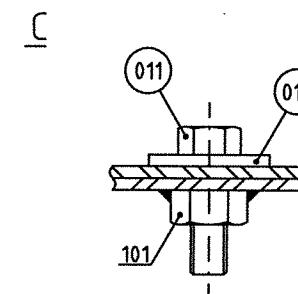
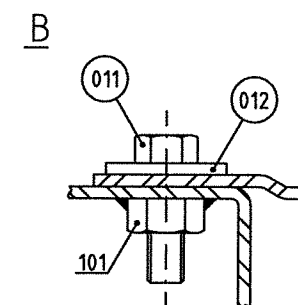




item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		SKHW COLLECTOR TRAY	BED No.4	304L	120
001	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
002	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
003	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
004	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
005	1	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
006	2	-	pcs.		SKHW COLLECTOR TRAY PANEL		304L	
007	2	-	pcs.		RISER		304L	
008	4	-	pcs.		HAT SUPPORT		304L	
009	2	-	pcs.		HAT SUPPORT		304L	
010	2	-	pcs.		RISER HAT		304L	
011	32	3	pcs.		HEX HEAD CAPSCREW - 3/8"-16 x 1 1/4" LONG		304L	0.0485
012	32	3	pcs.		WASHER - 7/16" I.D. x 1 1/4" O.D.		304L	0.0331
100	21	-	ft2		SHEET - 10 GA.		SHEET	5.67
101	32	-	pcs.		NUT - 3/8"-16 HEAVY HEX	TACKWELDED	304L	0.0314

001 - 099: parts / 100 - 199: materials

NOTE: MATERIAL FOR ALL PARTS TO BE 10GA.(MK. 100) EXCEPT AS NOTED.



RISER HATS ARE
NOT SHOWN IN THE PLAN
VIEW FOR CLARITY.

NOTE TO TRAY INSTALLER
CHIMNEY TRAY FLOOR, RISER & DOWNCOMER
TO BE COMPLETELY SEAL WELDED DOWN ALL
SEAMS, AT ALL JOINTS & BOLTING TO
PROVIDE A LIQUID TIGHT TRAY.

1	CERTIFIED ISSUE	TSa	2/17/17	RBa	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMa	1/6/17	RBa	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -212		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col.-I.D.: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.4		area:		ACAD 2000			

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state:
CERTIFIED

SULZER

SKHW COLLECTOR TRAY

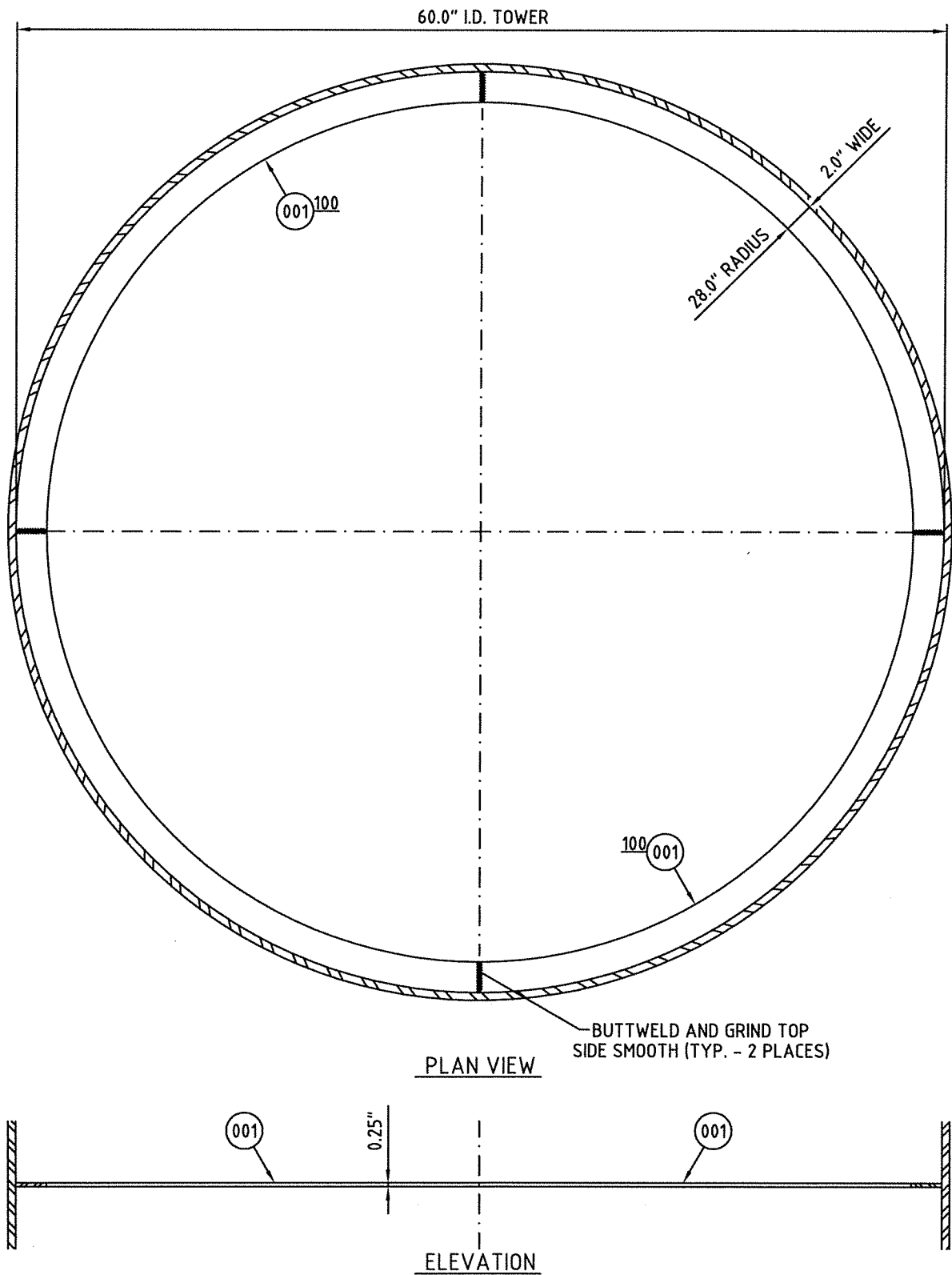
DEMETHANIZER TOWER

(BED No.4)

drawing no.:	sheet no.:
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9033982-02 16

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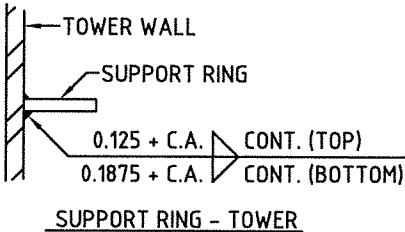
item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		WELD-INS FOR SKG, VSIR, & GIS	BED No.1	304L	29
001	4	-	pcs.		SUPPORT RING SEGMENT		304L	
100	2.54	-	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) SUPPORT RING. A QUANTITY OF 3 (THREE) SUPPORT RINGS AS SHOWN ON THIS SHEET ARE REQUIRED. ONE EACH FOR THE BED No.1 SKG GALLERY TRAY, VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE.

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL FABRICATOR OR CUSTOMER PROCEDURES



SHOP NOTES:

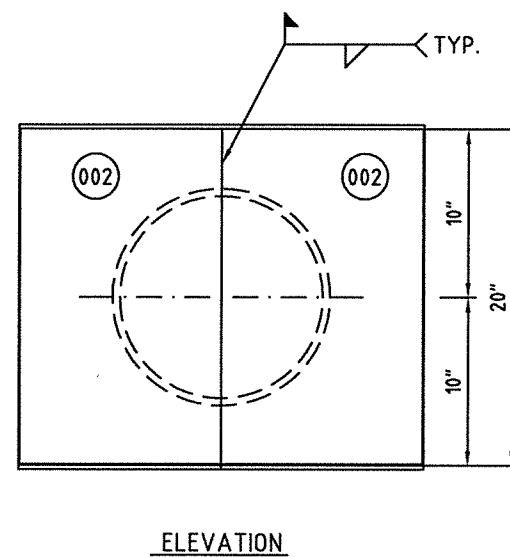
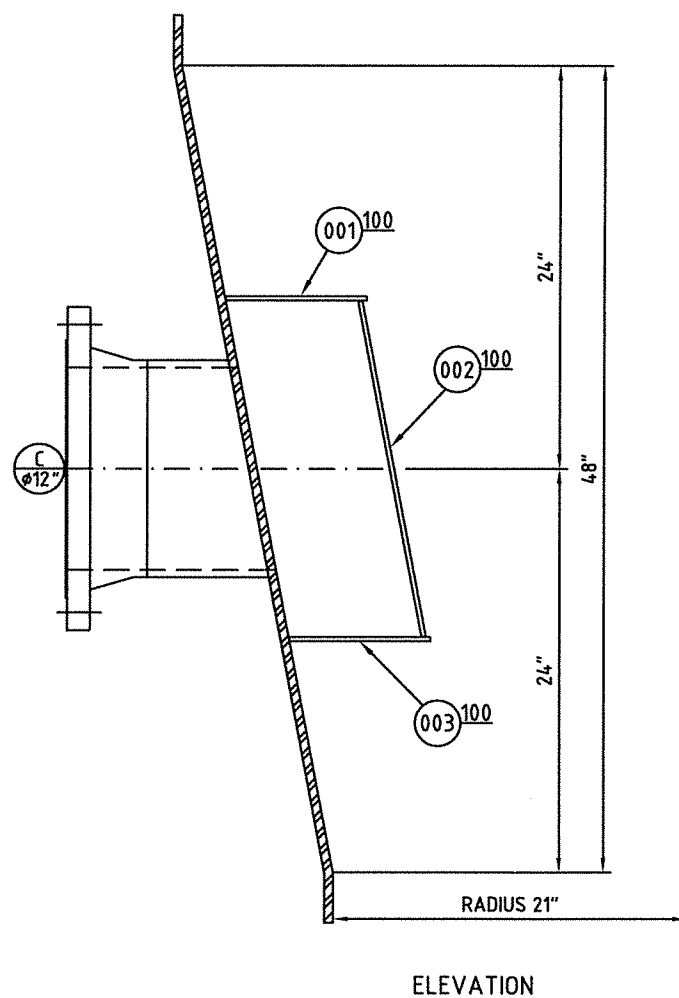
- 1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.125"
- 2. ALL WELD IN MATERIAL: 0.25" THICK 304L

GENERAL NOTES
All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state:
CERTIFIED

1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	-217	SULZER project no.:	9033982-02	size:	11x17	scale:	%
col.-I.D.:	60.0"	customer:	UOP RUSSELL LLC.	customer p.o.:	4500753897		
col item:	T-501	plant:		customer-dwg.:			
bed:	No.1	area:		ACAD 2000			
SULZER		WELD-INS FOR SKG, VSIR, AND GIS DEMETHANIZER TOWER (BED No.1)				drawing no.:	sheet no.:
						9033982-02	18

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item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. lb.
000	1	-	set		WELD-IN BAFFLE FOR NOZZLE "C"	BED No.2	304L	52
001	1	-	pce.		BAFFLE		304L	
002	2	-	pce.		BAFFLE		304L	
003	1	-	pce.		BAFFLE		304L	
100	4.7	-	ft2		PLATE - 1/4" THICK		304L	11.16

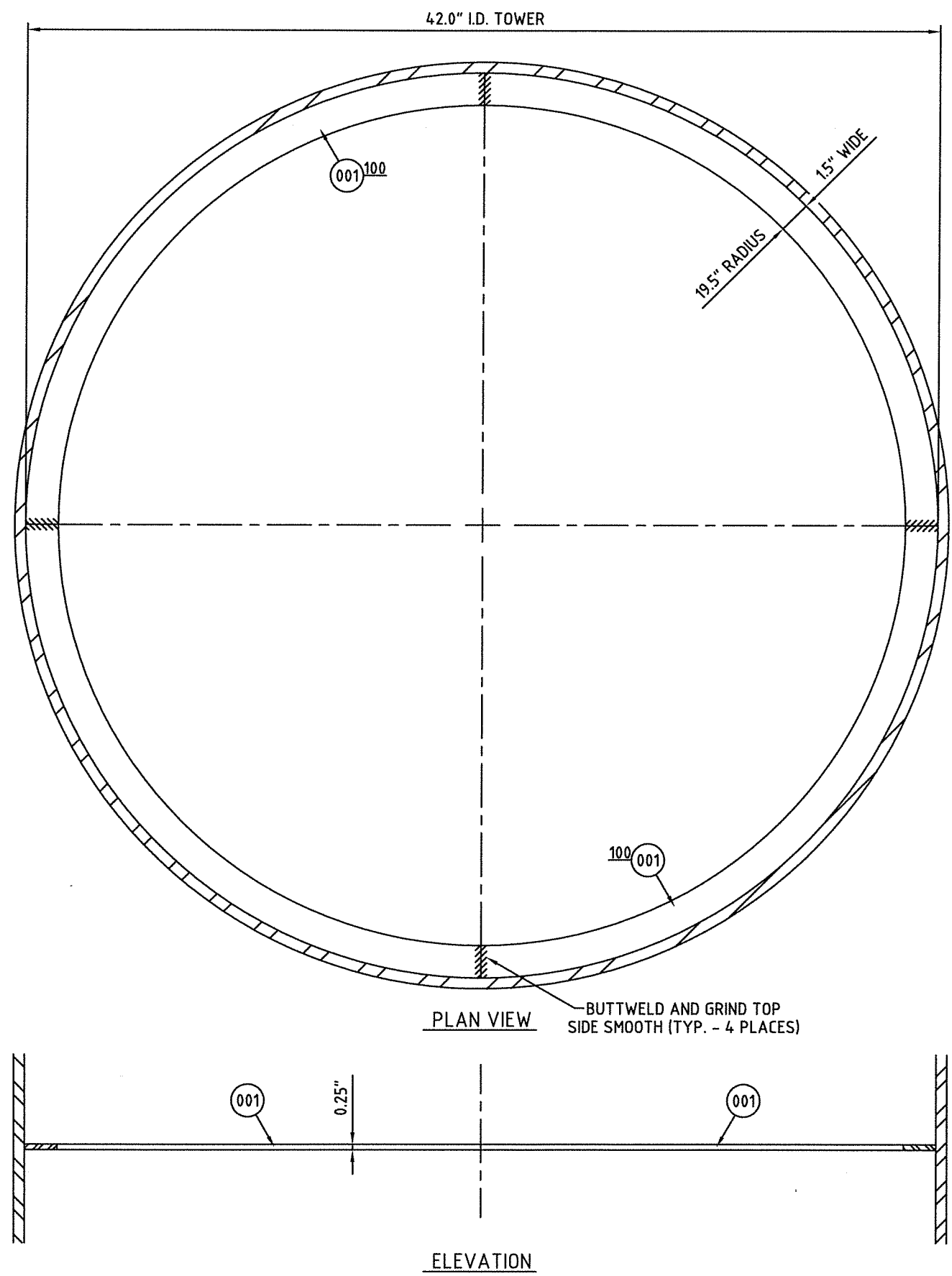
RECOMMENDED WELDING DETAILS

The diagrams illustrate the location of the center of gravity (C.G.) for different cross-sections of a tower wall, relative to the center line (CL) and the baffle segment.

- Diagram 1 (Left):** Shows a cross-section of a tower wall with a baffle segment. The C.G. is marked with a black dot on the center line (CL). The distance from the CL to the C.G. is labeled as $0.1875 + \text{C.A.} \nabla \text{CONT.}$. The baffle segment is labeled "BAFFLE SEGMENT".
- Diagram 2 (Top Right):** Shows a cross-section of a tower wall with a baffle segment. The C.G. is marked with a black dot on the baffle segment. The distance from the CL to the C.G. is labeled as $0.1875 + \text{C.A.} \nabla \text{CONT.}$. The baffle segment is labeled "BAFFLE SEGMENT".
- Diagram 3 (Bottom Right):** Shows a cross-section of a tower wall with a baffle segment. The C.G. is marked with a black dot on the baffle segment. The distance from the CL to the C.G. is labeled as $0.1875 + \text{C.A.} \nabla \text{CONT.}$. The baffle segment is labeled "BAFFLE SEGMENT" and the tower wall is labeled "TOWER WALL".

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: $\pm 0.1875"$
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

1	CERTIFIED ISSUE	TSa	2/17/17	RBa	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -215		SULZER project no.: 9033982-02				size: 11x17	scale: %
col.-I.D.: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg:			
bed: No.2		area:		ACAD 2000			
		WELD-IN BAFFLE FOR NOZZLE "C"				drawing no.:	sheet no.:
		DEMETHANIZER TOWER (BED No.2)				9033982-02	20
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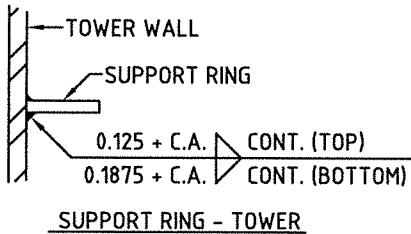
item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		WELD-INS FOR SKH, VSIR, EMS, & SKG	BEDS No.2,3,&4	304L	15.6
001	4	-	pcs.		SUPPORT RING SEGMENT		304L	
100	1.4	-	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) SUPPORT RING. A QUANTITY OF 9 (NINE) SUPPORT RINGS AS SHOWN ON THIS SHEET ARE REQUIRED. ONE EACH FOR THE BED No.2 SKH COLLECTOR TRAY, VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE; BED No.3 SKG GALLERY TRAY, VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE; AND BED No.4 SKG GALLERY TRAY, VSIR DISTRIBUTOR, AND GIS SUPPORT PLATE.

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL FABRICATOR OR CUSTOMER PROCEDURES



SHOP NOTES:

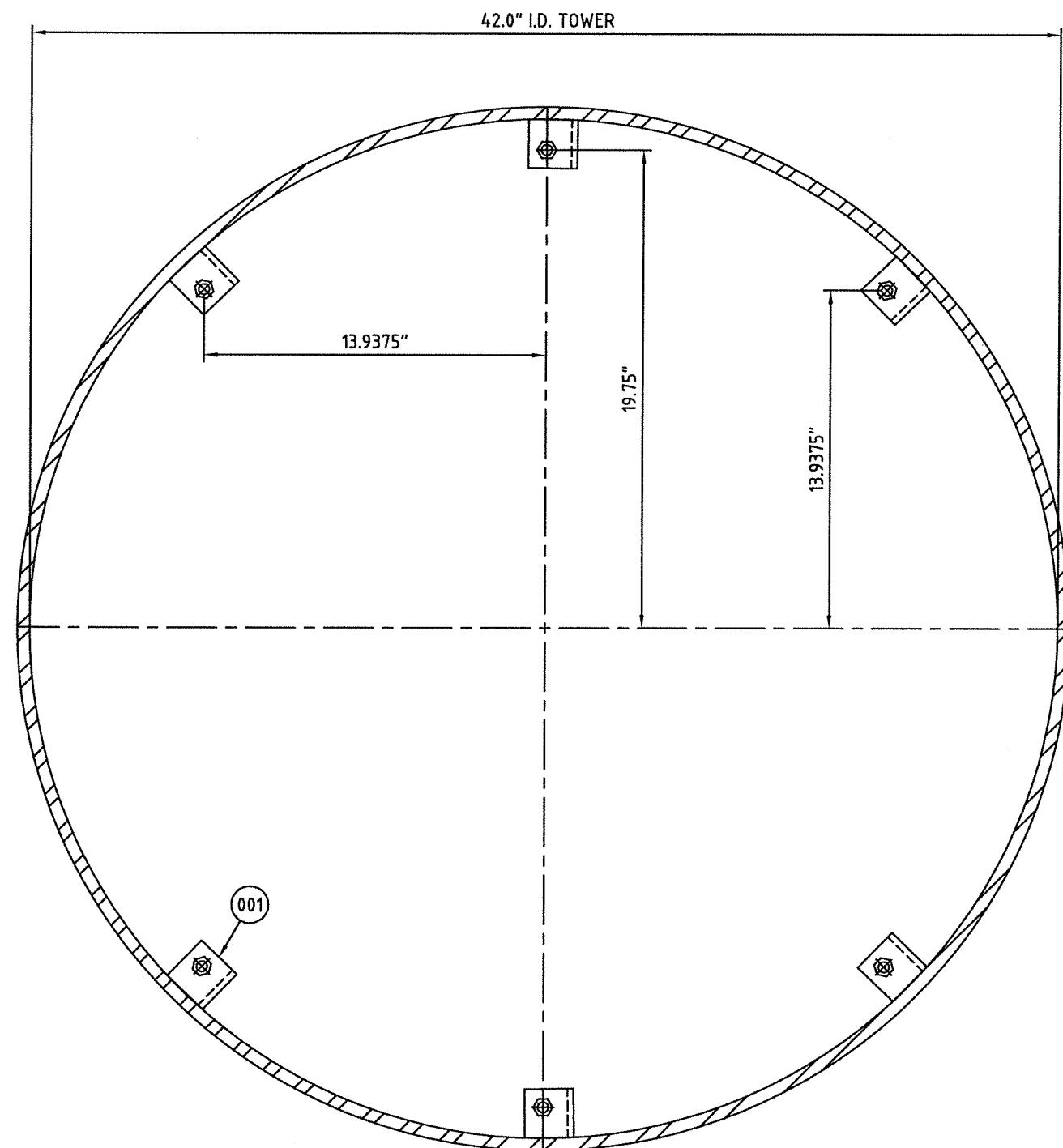
- 1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ±0.125"
- 2. ALL WELD IN MATERIAL: 0.25" THICK 304L

GENERAL NOTES

All parts shall pass through man ways:17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state:
CERTIFIED

1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	-218	SULZER project no.:	9033982-02	size:	11x17	scale:	%
col.-I.D.:	42.0"	customer:	UOP RUSSELL LLC.	customer p.o.:	4500753897		
col item:	T-501	plant:		customer-dwg.:			
bed:	No.2, 3, & 4	area:		ACAD 2000			
SULZER		WELD-INS FOR SKH, VSIR, GIS, AND SKG DEMETHANIZER TOWER (BEDS No.2, 3, & 4)				drawing no.:	sheet no.:
						9033982-02	21
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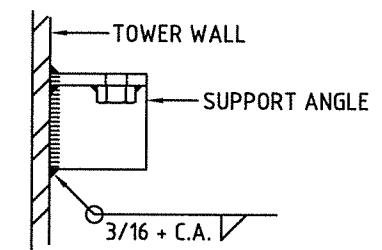


001 - 099: parts / 100 - 199: materials

NOTE: QUANTITIES SHOWN ABOVE ARE FOR 1 (ONE) SET OF SUPPORT CLIPS.
A QUANTITY OF 3 (THREE) SETS OF SUPPORT CLIPS AS SHOWN ON THIS
SHEET ARE REQUIRED. ONE EACH FOR THE BED No.2 RPB BED LIMITER,
BED No.3 RPB BED LIMITER, AND BED No.4 RPB BED LIMITER.

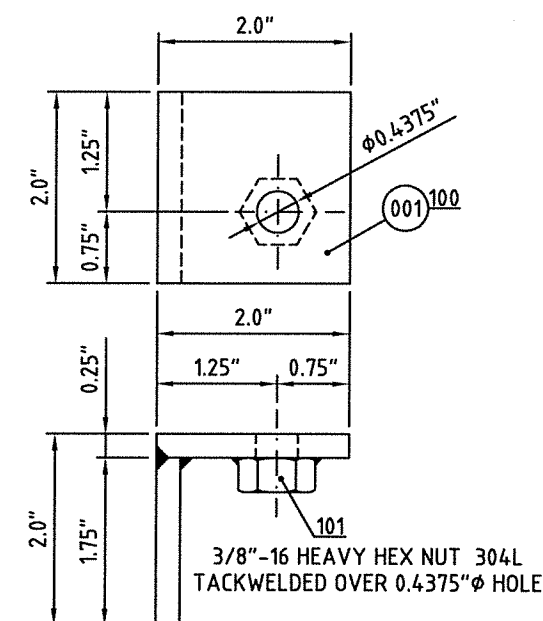
RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES

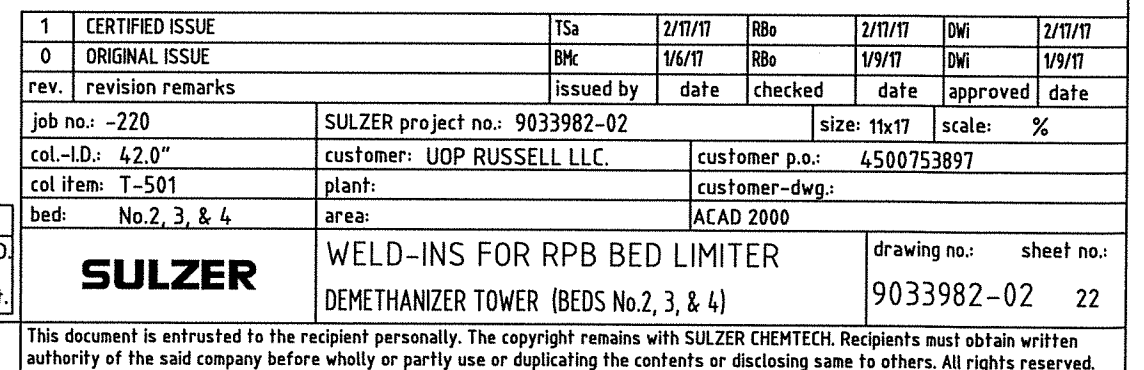


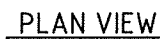
SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: $\pm 0.1875"$
2. ALL WELD IN MATERIAL: 0.25" THICK 304L



SUPPORT CLIP DETAIL
(6 - REQUIRED)





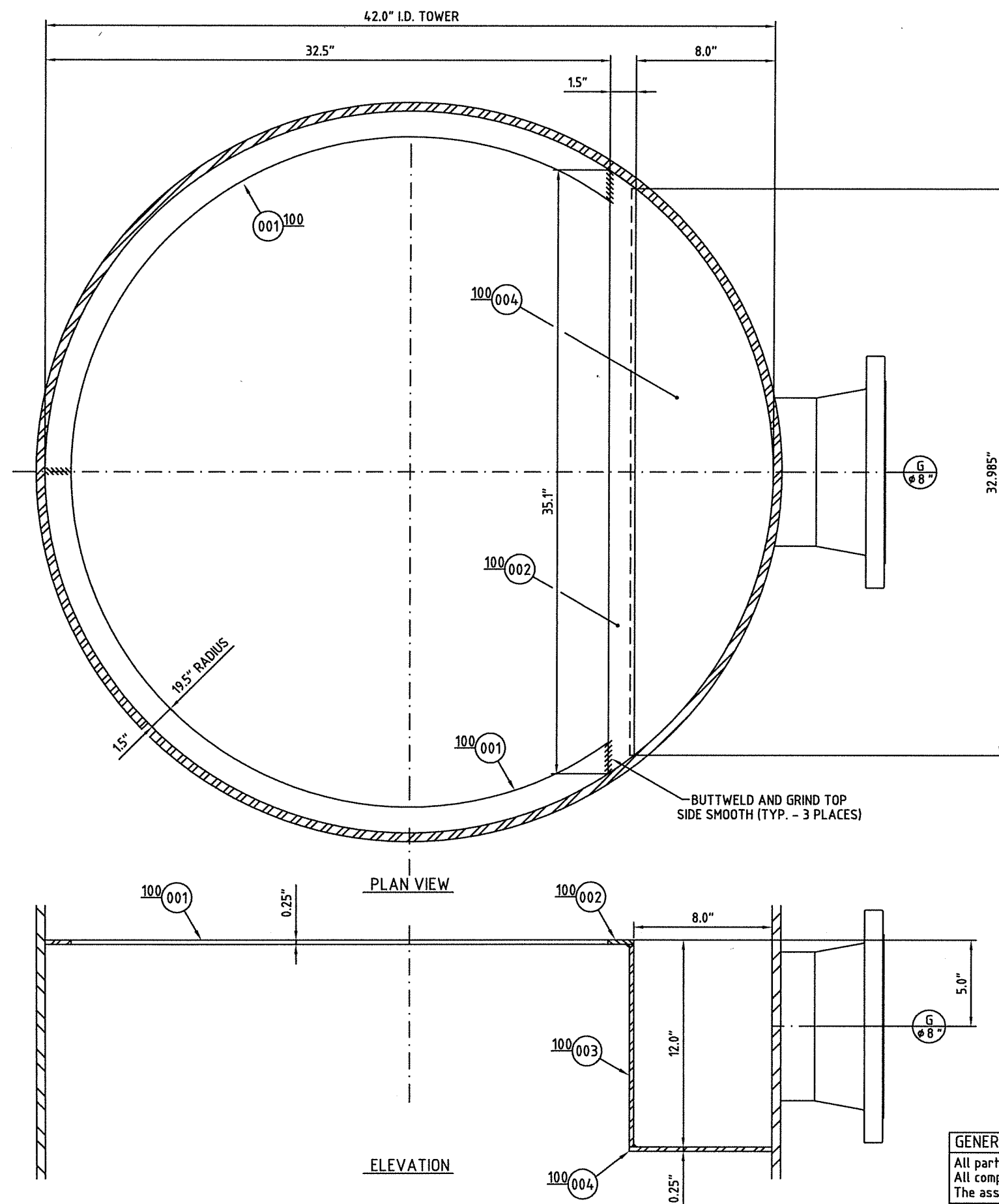
state:
CERTIFIED

001 - 099: parts / 100 - 199: materials



1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: $\pm 0.1875"$
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -215		SULZER project no.: 9033982-02			size: 11x17	scale: %	
col.-I.D.: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg:			
bed: No.3		area:		ACAD 2000			
		WELD-IN BAFFLE FOR NOZZLE "D" DEMETHANIZER TOWER (BED No.3)			drawing no.: sheet no.:		
					9033982-02 23		
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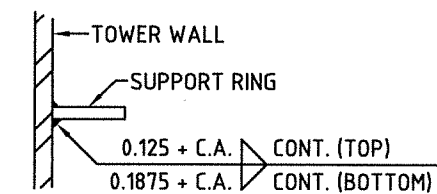


item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		WELD-INS FOR SKH, VSIR, EMS, & SKG	BED No.4	304L	60
001	2	-	pcs.		SUPPORT RING SEGMENT		304L	
002	1	-	pce.		SUPPORT LEDGE		304L	
003	1	-	pce.		SUMP WALL		304L	
004	1	-	pce.		SUMP FLOOR		304L	
100	5.4	-	ft2		PLATE - 1/4" THICK		304L	11.16

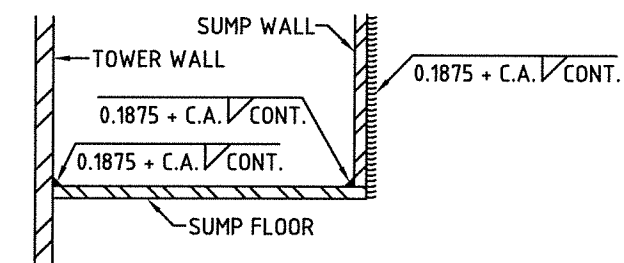
001 - 099: parts / 100 - 199: materials

RECOMMENDED WELDING DETAILS

WELD SIZE AS SPECIFIED DOES NOT CONSTITUTE
LIABILITY IN REGARDS TO CONFLICTION WITH VESSEL
FABRICATOR OR CUSTOMER PROCEDURES



SUPPORT RING - TOWER



SUMP FLOOR / SUMP WALL - TOWER

SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: $\pm 0.125"$
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

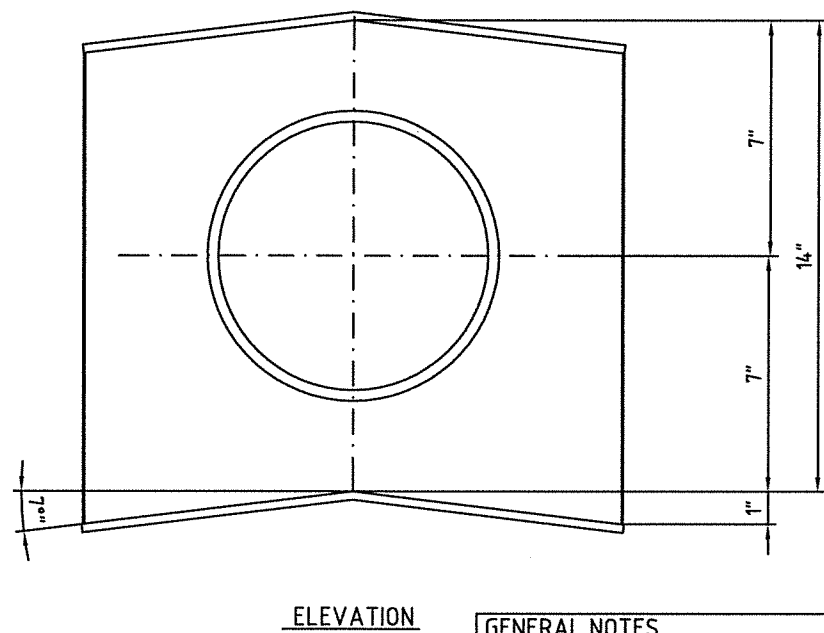
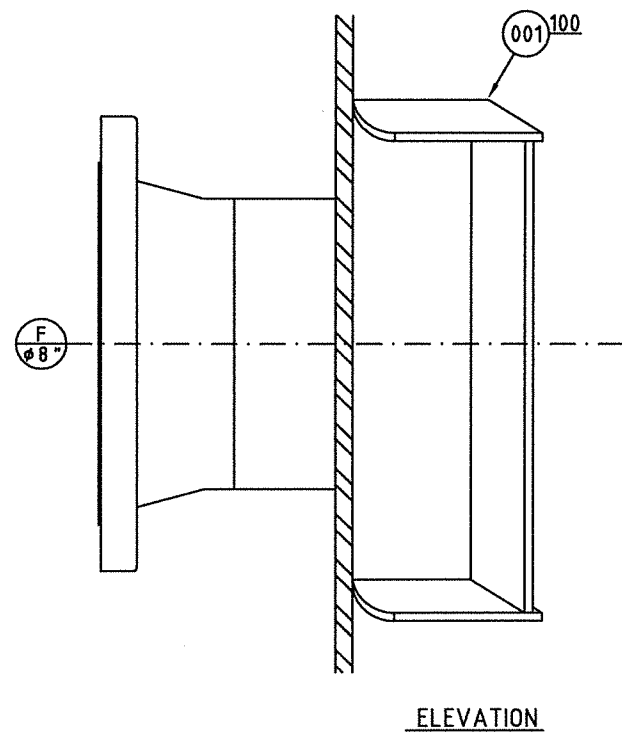
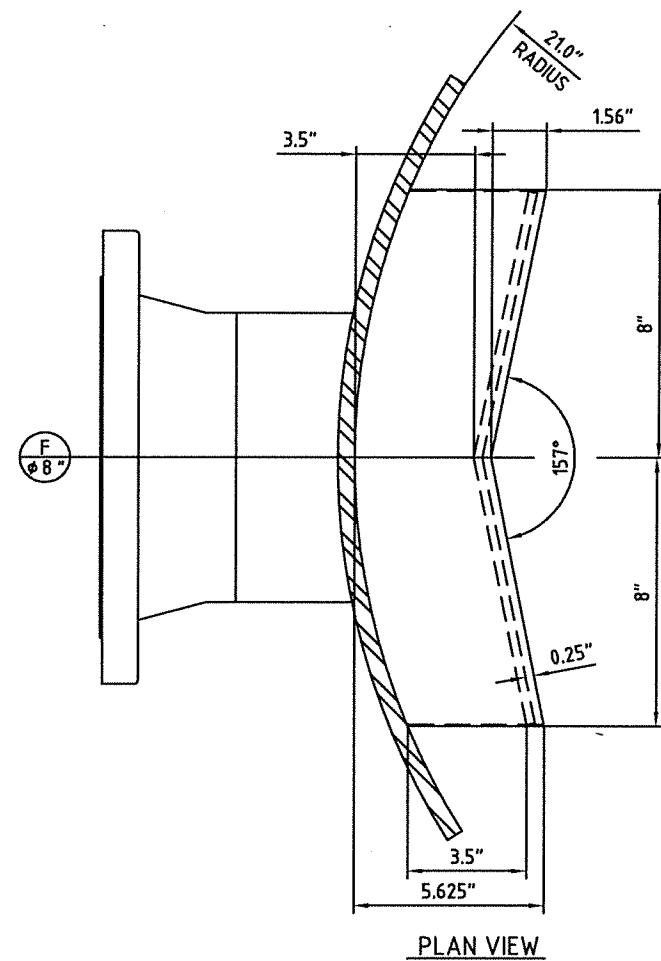
1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMk	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -219		SULZER project no.: 9033982-02				size: 11x17	scale: %
col.-I.D.: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.4		area:		ACAD 2000			
SULZER		WELD-INS FOR SKHW COLLECTOR TRAY DEMETHANIZER TOWER (BEDS No. 4)				drawing no.: 9033982-02	sheet no.: 24A
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GENERAL NOTES

All parts shall pass through man ways: 17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state:

CERTIFIED

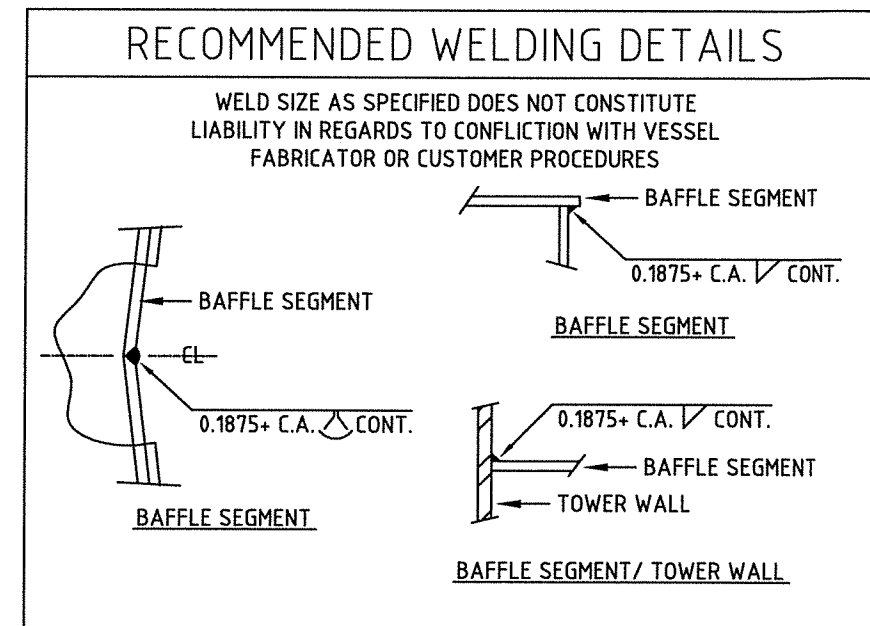


GENERAL NOTES
All parts shall pass through man ways: 17.25" I.D.
All components are marked by SULZER.
The assembled part is checked after manufact.

state:
CERTIFIED

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		WELD-IN BAFFLE FOR NOZZLE "F"	BED No.4	304L	32
001	1	-	pce.		BAFFLE		304L	
100	2.9	-	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials

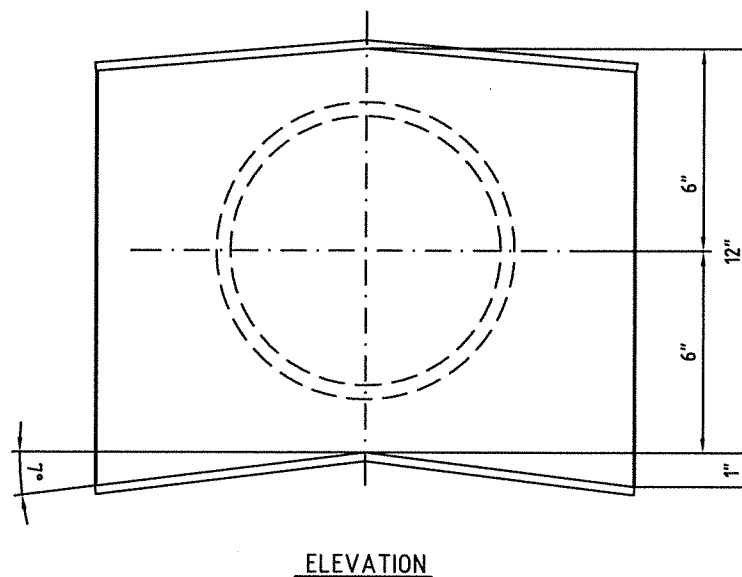
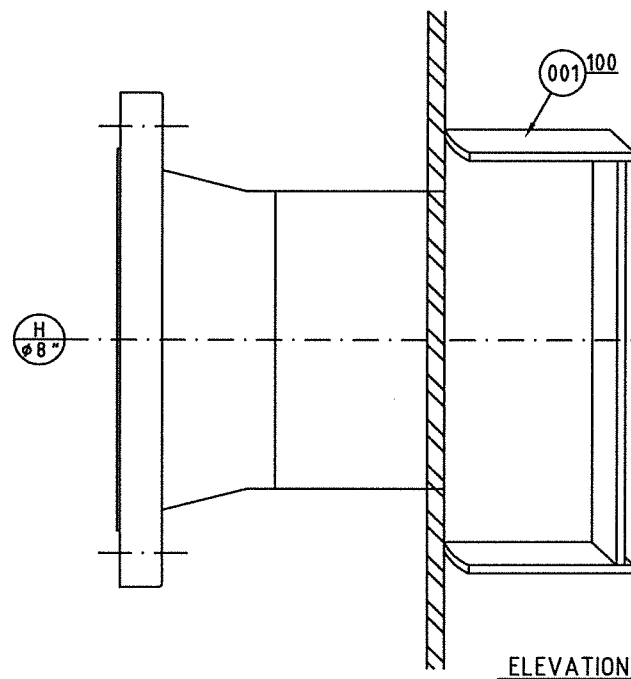
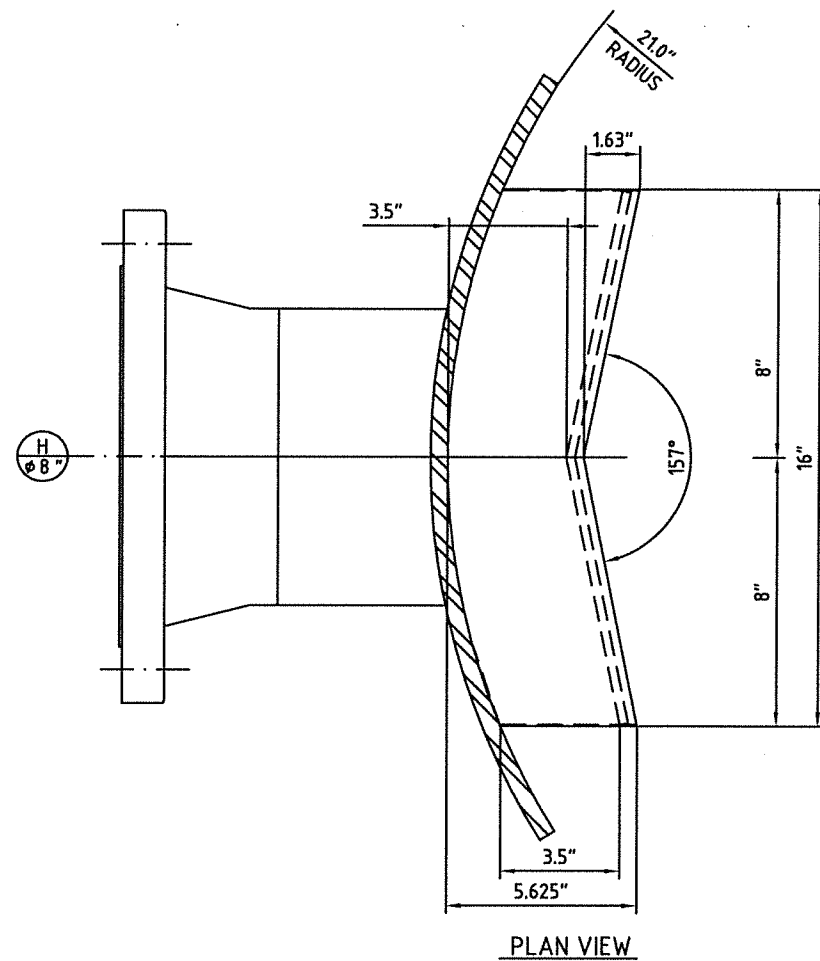


SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ± 0.1875 "
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

1	CERTIFIED ISSUE	TSa	2/17/17	RBo	2/17/17	DWi	2/17/17
0	ORIGINAL ISSUE	BMc	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.:	-215	SULZER project no.: 9033982-02			size: 11x17	scale: %	
col.-I.D.:	42.0"	customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item:	T-501	plant:		customer-dwg.:			
bed:	No.4	area:		ACAD 2000			
SULZER		WELD-IN BAFFLE FOR NOZZLE "F"				drawing no.:	sheet no.:
		DEMETHANIZER TOWER (BED No.4)				9033982-02	25

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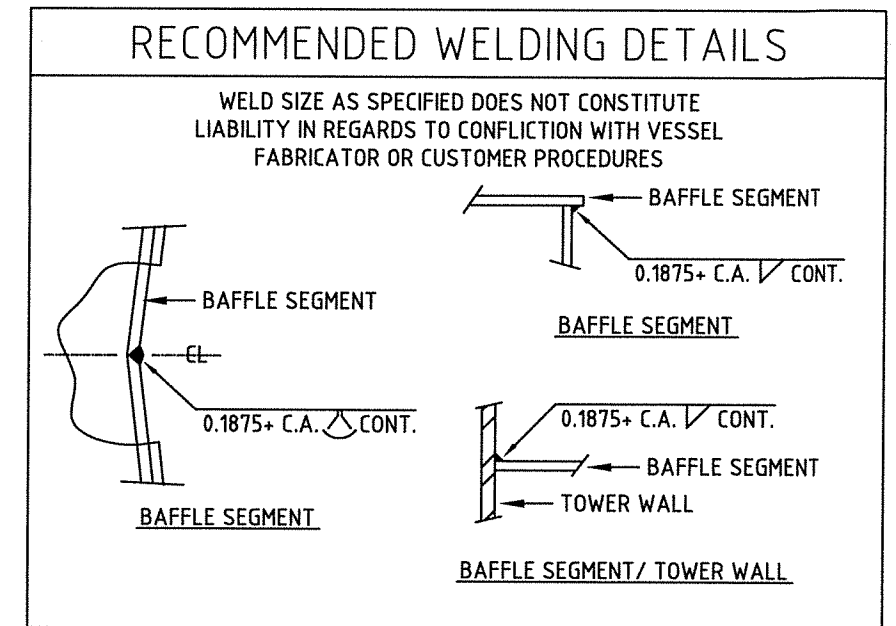


GENERAL NOTES
 All parts shall pass through man ways: 17.25" I.D.
 All components are marked by SULZER.
 The assembled part is checked after manufact.

state:
CERTIFIED

item list								
item	qty.	spare	unit	drawing- or part-no.	description	remarks	material	wght. [lb.]
000	1	-	set		WELD-IN BAFFLE FOR NOZZLE "H"	BED No.4	304L	15.6
001	1	-	pce.		BAFFLE		304L	
100	1.4	-	ft2		PLATE - 1/4" THICK		304L	11.16

001 - 099: parts / 100 - 199: materials



SHOP NOTES:

1. MAXIMUM HORIZONTAL LEVEL DEVIATIONS: ± 0.1875 "
2. ALL WELD IN MATERIAL: 0.25" THICK 304L

1	CERTIFIED ISSUE	TSa	2/11/17	RBo	2/11/17	DWi	2/11/17
0	ORIGINAL ISSUE	BMt	1/6/17	RBo	1/9/17	DWi	1/9/17
rev.	revision remarks	issued by	date	checked	date	approved	date
job no.: -215		SULZER project no.: 9033982-02				size: 11x17	scale: %
col.-I.D.: 42.0"		customer: UOP RUSSELL LLC.		customer p.o.: 4500753897			
col item: T-501		plant:		customer-dwg.:			
bed: No.4		area:		ACAD 2000			
SULZER		WELD-IN BAFFLE FOR NOZZLE "H"				drawing no.:	sheet no.:
		DEMETHANIZER TOWER (BED No.4)				9033982-02	26

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Section 2

Rating Sheets

Reference: 7120054 J258-18
Customer: THOMAS RUSSELL CO.
Service: DEMETHANIZER
Item: 1 T-501
Date Run: 5-Aug-2011

SUMMARY T-501 DEMETHANIZER

Section	NTS	Height [ft]	Diameter [in]	Material	Product	Pressure drop [mmHg]
1	4.0	15.000	60.00	304	NR2	3.44
2	3.0	10.000	42.00	304	NR2	1.50
3	3.0	10.000	42.00	304	NR2	0.49
4	4.0	12.000	42.00	304	NR1.5	0.39
Top pressure						9665.0
Total Pressure Drop						7.46



7120054 05-Aug-2011

Design Notes: === GSP-1 RCVY CASE @ 185 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....\T501_RCVY-GSP.suit

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FINAL COPY

Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 1 / 2 / 3

	Section 1 TOP SECTION	Section 2 UPPER MIDDLE SECTION	Section 3 LOWER MIDDLE SECTION
Geometry Data:			
Geometry:	B1_NR2	B2_NR2	B3_NR2
Packing Type:	NR2	NR2	NR2
Material:	304	304	304
Column Diameter [in]:	60.00	42.00	42.00
Packing height [ft]:	15.000	10.000	10.000
NTS:	4.0	3.0	3.0
HETP [in]:	45	40	40
Sheet Thickness [in]:	0.0157	0.0157	0.0157
Dry Weight [lb]:	2647.66	864.90	864.90

Fluid Data:

	Top	Btm	Top	Btm	Top	Btm
Gas:						
Mult. Vapor Rate [lb/h]:	69150.0	67970.0	27350.0	27310.0	9242.0	16030.0
Density [lb/ft³]:	1.0610	1.0340	1.0210	0.9870	0.9974	1.2130
Viscosity [cP]:	0.0076	0.0078	0.0079	0.0082	0.0084	0.0090
QV [cfs]:	18.10	18.26	7.44	7.69	2.57	3.67
Liquid:						
Mult. Liquid Rate [lb/h]:	21910.0	17310.0	26010.0	25960.0	69490.0	76280.0
Density [lb/ft³]:	26.92	32.06	32.44	32.46	34.08	33.08
Surface Tension [dyne/cm]:	7.90	11.81	12.06	11.94	12.92	11.11
Viscosity [cP]:	0.086	0.131	0.137	0.133	0.159	0.133
QL [gpm]:	101.47	67.32	99.96	99.71	254.22	287.49
System Factor:	0.90	0.90	0.90	0.90	1.00	1.00

Calculated Output:

Capacity [%]:	58.9	50.8	54.3	54.8	34.3	46.8
F-Factor [US]:	0.95	0.95	0.78	0.79	0.27	0.42
Spec. liquid load [gpm/ft²]:	5.17	3.43	10.39	10.36	26.43	29.88
Pressure drop [in w./ft]:	0.15	0.09	0.08	0.08	0.01	0.04
Flow Parameter:	0.063	0.046	0.169	0.166	1.286	0.911
Liquid Holdup [%]:	1.5		2.6		4.8	
Bed pressure drop [mmHg]:	3.44		1.50		0.49	

Design Notes: === GSP-1 RCVY CASE @ 185 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa...\T501_RCVY-GSP.su1

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Page 2 of 4

FINAL COPY

Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 4

Section 4
BOTTOM SECTION

Geometry Data:

Geometry:	B4_NR1.5
Packing Type:	NR1.5
Material:	304
Column Diameter [in]:	42.00
Packing height [ft]:	12.000
NTS:	4.0
HETP [in]:	36
Sheet Thickness [in]:	0.0157
Dry Weight [lb]:	1304.56

Fluid Data:

	Top	Btm
Gas:		
Mult. Vapor Rate [lb/h]:	6414.0	10530.0
Density [lb/ft ³]:	1.2470	1.4050
Viscosity [cP]:	0.0090	0.0090
QV [cfs]:	1.43	2.08
Liquid:		
Mult. Liquid Rate [lb/h]:	66660.0	70780.0
Density [lb/ft ³]:	32.21	31.45
Surface Tension [dyne/cm]:	9.27	8.03
Viscosity [cP]:	0.118	0.108
QL [gpm]:	258.02	280.59
System Factor:	1.00	1.00

Calculated Output:

Capacity [%]:	31.6	40.8
F-Factor [US]:	0.17	0.26
Spec. liquid load [gpm/ft ²]:	26.82	29.17
Pressure drop [in w./ft]:	0.01	0.03
Flow Parameter:	2.045	1.421
 Liquid Holdup [%]:	 5.5	
Bed pressure drop [mmHg]:	0.39	

Design Notes: === GSP-1 RCVY CASE @ 185 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa...\T501_RCVY-GSP.suit

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

INTERNALS Section 1 - 4**Section 1****Distributor**

Type: VSIR
 Material: 1.4307
 DPD [1/ft²]: 7.43
 Quality: g
 LSL [%]: 50
 Range [%]: 30-120
 Range [gpm]: 30.44-121.77
 Cost-F.: 1.0

d_hole [in]: 0.2
 Height [in]: 28
 Weight [lb]: 633
 Holdup [ft³]: 38.846
 Beams:
 Bm.type:
 dp [mmHg]: 0.67
 LSL [gpm]: 50.74

Collector

Type: SK
 Material: 1.4307
 Height [in]: 12
 A-free [%]: 60.351
 Weight [lb]: 302
 Holdup [ft³]: 5.121
 dp [mmHg]: 0.024
 Cost-F.: 1.0

Support

Type: GIS
 Material: 1.4307
 Height [in]: 12
 Weight [lb]: 161
 Cost-F.: 1.0

Section 2**Distributor**

Type: VSIR
 Material: 1.4307
 DPD [1/ft²]: 7.43
 Quality: g
 LSL [%]: 50
 Range [%]: 30-120
 Range [gpm]: 29.99-119.96
 Cost-F.: 1.0

d_hole [in]: 0.3
 Height [in]: 28
 Weight [lb]: 293
 Holdup [ft³]: 18.717
 Beams:
 Bm.type:
 dp [mmHg]: 0.45
 LSL [gpm]: 49.98

Collector

Type: SK
 Material: 1.4307
 Height [in]: 12
 A-free [%]: 15.000
 Weight [lb]: 190
 Holdup [ft³]: 5.368
 dp [mmHg]: 0.312
 Cost-F.: 1.0

Support

Type: EMS
 Material: 1.4307
 Height [in]: 4
 Weight [lb]: 79
 Cost-F.: 1.0

Section 3**Distributor**

Type: VSIR
 Material: 1.4307
 DPD [1/ft²]: 7.43
 Quality: g
 LSL [%]: 50
 Range [%]: 30-120
 Range [gpm]: 76.27-305.07
 Cost-F.: 1.0

d_hole [in]: 0.5
 Height [in]: 27
 Weight [lb]: 291
 Holdup [ft³]: 18.364
 Beams:
 Bm.type:
 dp [mmHg]: 0.05
 LSL [gpm]: 127.11

Collector

Type: SK
 Material: 1.4307
 Height [in]: 12
 A-free [%]: 15.000
 Weight [lb]: 190
 Holdup [ft³]: 5.368
 dp [mmHg]: 0.087
 Cost-F.: 1.0

Support

Type: EMS
 Material: 1.4307
 Height [in]: 4
 Weight [lb]: 79
 Cost-F.: 1.0

Section 4**Distributor**

Type: VSIR
 Material: 1.4307
 DPD [1/ft²]: 7.43
 Quality: g
 LSL [%]: 50
 Range [%]: 30-120
 Range [gpm]: 77.41-309.63
 Cost-F.: 1.0

d_hole [in]: 0.5
 Height [in]: 28
 Weight [lb]: 295
 Holdup [ft³]: 19.070
 Beams:
 Bm.type:
 dp [mmHg]: 0.02
 LSL [gpm]: 129.01

Collector

Type: SK
 Material: 1.4307
 Height [in]: 12
 A-free [%]: 15.000
 Weight [lb]: 190
 Holdup [ft³]: 5.368
 dp [mmHg]: 0.033
 Cost-F.: 1.0

Support

Type: EMS
 Material: 1.4307
 Height [in]: 4
 Weight [lb]: 79
 Cost-F.: 1.0

Design Notes: === GSP-1 RCVY CASE @ 185 PSIA ===

Engineer Name: GHS

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See USIR / SKG Summary

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Reference: 7120054 J258-18
Customer: THOMAS RUSSELL CO.
Service: DEMETHANIZER
Item: 1 T-501
Date Run: 29-Jul-2011

SUMMARY T-501 DEMETHANIZER

Section	NTS	Height [ft]	Diameter [in]	Material	Product	Pressure drop [mmHg]
1	4.0	15.000	60.00	304	NR2	5.06
2	3.0	10.000	42.00	304	NR2	0.46
3	3.0	10.000	42.00	304	NR2	0.38
4	4.0	12.000	42.00	304	NR1.5	0.22
Top pressure						13442.0
Total Pressure Drop						7.15



7120054 05-Aug-2011

Design Notes: === RCVY CASE-120° @ 260 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....T501_RCVY-120°.su

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 29-Jul-2011

PACKING DESIGN Section 1 / 2 / 3

	Section 1 TOP SECTION	Section 2 UPPER MIDDLE SECTION	Section 3 LOWER MIDDLE SECTION
Geometry Data:			
Geometry:	B1_NR2	B2_NR2	B3_NR2
Packing Type:	NR2	NR2	NR2
Material:	304	304	304
Column Diameter [in]:	60.00	42.00	42.00
Packing height [ft]:	15.000	10.000	10.000
NTS:	4.0	3.0	3.0
HETP [in]:	45	40	40
Sheet Thickness [in]:	0.0157	0.0157	0.0157
Dry Weight [lb]:	2647.66	864.90	864.90

Fluid Data:

	Top	Btm	Top	Btm	Top	Btm
Gas:						
Mult. Vapor Rate [lb/h]:	87440.0	80760.0	16340.0	16340.0	10630.0	17890.0
Density [lb/ft ³]:	1.6660	1.5110	1.4960	1.4400	1.4790	1.8320
Viscosity [cP]:	0.0076	0.0080	0.0081	0.0085	0.0088	0.0097
QV [cfs]:	14.58	14.85	3.03	3.15	2.00	2.71
Liquid:						
Mult. Liquid Rate [lb/h]:	30050.0	20630.0	30700.0	30690.0	50240.0	57500.0
Density [lb/ft ³]:	24.09	30.40	31.03	31.50	33.44	32.70
Surface Tension [dyne/cm]:	5.39	9.72	10.16	10.55	11.58	9.66
Viscosity [cP]:	0.061	0.102	0.115	0.115	0.141	0.117
QL [gpm]:	155.52	84.61	123.35	121.47	187.31	219.23
System Factor:	0.90	0.90	0.90	0.90	1.00	1.00

Calculated Output:

Capacity [%]:	68.3	53.6	36.2	36.2	29.2	39.9
F-Factor [US]:	0.96	0.93	0.39	0.39	0.25	0.38
Spec. liquid load [gpm/ft ²]:	7.92	4.31	12.82	12.63	19.47	22.79
Pressure drop [in w./ft]:	0.25	0.11	0.02	0.02	0.01	0.03
Flow Parameter:	0.090	0.057	0.413	0.402	0.994	0.761
Liquid Holdup [%]:	1.8		2.9		3.9	
Bed pressure drop [mmHg]:	5.06		0.46		0.38	

Design Notes: === RCVY CASE-120° @ 260 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....T501 RCVY-120°.su1

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 29-Jul-2011

PACKING DESIGN Section 4

Section 4
BOTTOM SECTION

Geometry Data:

Geometry:	B4_NR1.5
Packing Type:	NR1.5
Material:	304
Column Diameter [in]:	42.00
Packing height [ft]:	12.000
NTS:	4.0
HETP [in]:	36
Sheet Thickness [in]:	0.0157
Dry Weight [lb]:	1304.56

Fluid Data:

	Top	Btm
Gas:		
Mult. Vapor Rate [lb/h]:	6686.0	9554.0
Density [lb/ft ³]:	1.8910	2.0420
Viscosity [cP]:	0.0098	0.0098
QV [cfs]:	0.98	1.30
Liquid:		
Mult. Liquid Rate [lb/h]:	46290.0	49160.0
Density [lb/ft ³]:	31.81	31.00
Surface Tension [dyne/cm]:	7.86	6.67
Viscosity [cP]:	0.107	0.099
QL [gpm]:	181.43	197.71
System Factor:	1.00	1.00

Calculated Output:

Capacity [%]:	24.5	30.1
F-Factor [US]:	0.14	0.19
Spec. liquid load [gpm/ft ²]:	18.86	20.55
Pressure drop [in w./ft]:	0.01	0.01
Flow Parameter:	1.688	1.321
Liquid Holdup [%]:	4.3	
Bed pressure drop [mmHg]:	0.22	

Design Notes: === RCVY CASE-120° @ 260 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....T501_RCVY-120°.sult

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 29-Jul-2011

INTERNALS Section 1 - 4**Section 1****Distributor**

Type: **VSIR**
 Material: **1.4307**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **46.66-186.63**
 Cost-F.: **1.0**

d_hole [in]: **0.3**
 Height [in]: **29**
 Weight [lb]: **644**
 Holdup [ft³]: **40.259**
 Beams:
 Bm.type:
 dp [mmHg]: **0.68**
 LSL [gpm]: **77.76**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **60.351**
 Weight [lb]: **302**
 Holdup [ft³]: **5.121**
 dp [mmHg]: **0.023**
 Cost-F.: **1.0**

Support

Type: **GIS**
 Material: **1.4307**
 Height [in]: **12**
 Weight [lb]: **161**
 Cost-F.: **1.0**

Section 2**Distributor**

Type: **VSIR**
 Material: **1.4307**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **37.01-148.02**
 Cost-F.: **1.0**

d_hole [in]: **0.3**
 Height [in]: **28**
 Weight [lb]: **293**
 Holdup [ft³]: **18.717**
 Beams:
 Bm.type:
 dp [mmHg]: **0.11**
 LSL [gpm]: **61.68**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.076**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Section 3**Distributor**

Type: **VSIR**
 Material: **1.4307**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **56.19-224.78**
 Cost-F.: **1.0**

d_hole [in]: **0.4**
 Height [in]: **28**
 Weight [lb]: **293**
 Holdup [ft³]: **19.070**
 Beams:
 Bm.type:
 dp [mmHg]: **0.05**
 LSL [gpm]: **93.66**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.072**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Section 4**Distributor**

Type: **VSIR**
 Material: **1.4307**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **54.43-217.72**
 Cost-F.: **1.0**

d_hole [in]: **0.4**
 Height [in]: **29**
 Weight [lb]: **298**
 Holdup [ft³]: **19.423**
 Beams:
 Bm.type:
 dp [mmHg]: **0.02**
 LSL [gpm]: **90.72**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.018**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Design Notes: === RCVY CASE-120° @ 260 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....T501_RCVY-120°

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Note: See the VSIR and SKG summary sheets for the flows for all cases.

Reference: 7120054 J258-18
Customer: THOMAS RUSSELL CO.
Service: DEMETHANIZER
Item: 1 T-501
Date Run: 5-Aug-2011

SUMMARY T-501 DEMETHANIZER

Section	NTS	Height [ft]	Diameter [in]	Material	Product	Pressure drop [mmHg]
1	4.0	15.000	60.00	304	NR2	4.14
2	3.0	10.000	42.00	304	NR2	0.88
3	3.0	10.000	42.00	304	NR2	1.36
4	4.0	12.000	42.00	304	NR1.5	1.20
Top pressure						11116.0
Total Pressure Drop						9.26



7120054 05-Aug-2011

Design Notes: === REJ C1 CASE @ 215 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....gn\T501_REJ-C1_sul

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 1 / 2 / 3

	Section 1 TOP SECTION	Section 2 UPPER MIDDLE SECTION	Section 3 LOWER MIDDLE SECTION
Geometry Data:			
Geometry:	B1_NR2	B2_NR2	B3_NR2
Packing Type:	NR2	NR2	NR2
Material:	304	304	304
Column Diameter [in]:	60.00	42.00	42.00
Packing height [ft]:	15.000	10.000	10.000
NTS:	4.0	3.0	3.0
HETP [in]:	45	40	40
Sheet Thickness [in]:	0.0157	0.0157	0.0157
Dry Weight [lb]:	2647.66	864.90	864.90

Fluid Data:

	Top	Btm	Top	Btm	Top	Btm
Gas:						
Mult. Vapor Rate [lb/h]:	82530.0	80950.0	20960.0	22780.0	14590.0	25790.0
Density [lb/ft³]:	1.1880	1.1480	1.1960	1.2090	1.4290	1.6500
Viscosity [cP]:	0.0084	0.0086	0.0089	0.0092	0.0093	0.0093
QV [cfs]:	19.30	19.59	4.87	5.23	2.84	4.34
Liquid:						
Mult. Liquid Rate [lb/h]:	15500.0	13770.0	24530.0	26340.0	60140.0	71350.0
Density [lb/ft³]:	28.01	32.11	32.94	32.03	32.90	30.64
Surface Tension [dyne/cm]:	8.40	11.30	11.82	10.15	10.46	6.99
Viscosity [cP]:	0.093	0.126	0.138	0.119	0.131	0.100
QL [gpm]:	68.99	53.47	92.84	102.53	227.90	290.33
System Factor:	0.90	0.90	0.90	0.90	1.00	1.00

Calculated Output:

Capacity [%]:	60.4	54.7	41.2	45.3	38.5	58.4
F-Factor [US]:	1.07	1.07	0.55	0.60	0.35	0.58
Spec. liquid load [gpm/ft²]:	3.51	2.72	9.65	10.66	23.69	30.18
Pressure drop [in w./ft]:	0.17	0.12	0.04	0.06	0.02	0.12
Flow Parameter:	0.039	0.032	0.223	0.225	0.859	0.642
Liquid Holdup [%]:	1.3		2.6		4.5	
Bed pressure drop [mmHg]:	4.14		0.88		1.36	

Design Notes: === REJ C1 CASE @ 215 PSIA ===

Engineer Name: GHS

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 4

Section 4
BOTTOM SECTION

Geometry Data:

Geometry:	B4_NR1.5
Packing Type:	NR1.5
Material:	304
Column Diameter [in]:	42.00
Packing height [ft]:	12.000
NTS:	4.0
HETP [in]:	36
Sheet Thickness [in]:	0.0157
Dry Weight [lb]:	1304.56

Fluid Data:

	Top	Btm
Gas:		
Mult. Vapor Rate [lb/h]:	15090.0	16020.0
Density [lb/ft³]:	1.6700	1.7030
Viscosity [cP]:	0.0093	0.0095
QV [cfs]:	2.51	2.61
Liquid:		
Mult. Liquid Rate [lb/h]:	60650.0	61580.0
Density [lb/ft³]:	30.54	30.39
Surface Tension [dyne/cm]:	6.61	6.37
Viscosity [cP]:	0.099	0.098
QL [gpm]:	247.60	252.63
System Factor:	1.00	1.00

Calculated Output:

Capacity [%]:	44.7	46.4
F-Factor [US]:	0.34	0.35
Spec. liquid load [gpm/ft²]:	25.74	26.26
Pressure drop [in w./ft]:	0.05	0.06
Flow Parameter:	0.940	0.910
 Liquid Holdup [%]:	 5.1	
Bed pressure drop [mmHg]:	1.20	

Design Notes: === REJ C1 CASE @ 215 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....gn\T501_REJ-C1.sult

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

INTERNALS Section 1 - 4**Section 1**

Distributor			Collector			Support		
Type:	VSIR		d_hole [in]:	0.2	Type:	SK	Type:	GIS
			Height [in]:	29			Material:	1.4307
Material:	1.4307		Weight [lb]:	644	Material:	1.4307	Height [in]:	12
DPD [1/ft ²]:	7.43		Holdup [ft ³]:	39.906	Height [in]:	12	Weight [lb]:	161
Quality:	g		Beams:		A-free [%]:	60.351	Cost-F.:	1.0
LSL [%]:	50		Bm.type:		Weight [lb]:	302		
Range [%]:	30-120		dp [mmHg]:	0.85	Holdup [ft ³]:	5.121		
Range [gpm]:	20.70-82.79		LSL [gpm]:	34.50	dp [mmHg]:	0.031		
Cost-F.:	1.0				Cost-F.:	1.0		

Section 2

Distributor			Collector			Support		
Type:	VSIR		d_hole [in]:	0.3	Type:	SK	Type:	EMS
			Height [in]:	28			Material:	1.4307
Material:	1.4307		Weight [lb]:	295	Material:	1.4307	Height [in]:	4
DPD [1/ft ²]:	7.43		Holdup [ft ³]:	19.070	Height [in]:	12	Weight [lb]:	79
Quality:	g		Beams:		A-free [%]:	15.000	Cost-F.:	1.0
LSL [%]:	50		Bm.type:		Weight [lb]:	190		
Range [%]:	30-120		dp [mmHg]:	0.23	Holdup [ft ³]:	5.368		
Range [gpm]:	27.85-111.42		LSL [gpm]:	46.42	dp [mmHg]:	0.177		
Cost-F.:	1.0				Cost-F.:	1.0		

Section 3

Distributor			Collector			Support		
Type:	VSIR		d_hole [in]:	0.5	Type:	SK	Type:	EMS
			Height [in]:	28			Material:	1.4307
Material:	1.4307		Weight [lb]:	293	Material:	1.4307	Height [in]:	4
DPD [1/ft ²]:	7.43		Holdup [ft ³]:	19.070	Height [in]:	12	Weight [lb]:	79
Quality:	g		Beams:		A-free [%]:	15.000	Cost-F.:	1.0
LSL [%]:	50		Bm.type:		Weight [lb]:	190		
Range [%]:	30-120		dp [mmHg]:	0.09	Holdup [ft ³]:	5.368		
Range [gpm]:	68.37-273.49		LSL [gpm]:	113.95	dp [mmHg]:	0.166		
Cost-F.:	1.0				Cost-F.:	1.0		

Section 4

Distributor			Collector			Support		
Type:	VSIR		d_hole [in]:	0.5	Type:	SK	Type:	EMS
			Height [in]:	28			Material:	1.4307
Material:	1.4307		Weight [lb]:	295	Material:	1.4307	Height [in]:	4
DPD [1/ft ²]:	7.43		Holdup [ft ³]:	19.070	Height [in]:	12	Weight [lb]:	79
Quality:	g		Beams:		A-free [%]:	15.000	Cost-F.:	1.0
LSL [%]:	50		Bm.type:		Weight [lb]:	190		
Range [%]:	30-120		dp [mmHg]:	0.08	Holdup [ft ³]:	5.368		
Range [gpm]:	74.28-297.12		LSL [gpm]:	123.80	dp [mmHg]:	0.062		
Cost-F.:	1.0				Cost-F.:	1.0		

Design Notes: === REJ C1 CASE @ 215 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....gn\T501\REJ-C1.suit

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Page 4 of 4

Note: See the VSIR (SRG Summary)

ORIGINAL COPY

Reference: 7120054 J258-18
Customer: THOMAS RUSSELL CO.
Service: DEMETHANIZER
Item: 1 T-501
Date Run: 5-Aug-2011

SUMMARY T-501 DEMETHANIZER

Section	NTS	Height [ft]	Diameter [in]	Material	Product	Pressure drop [mmHg]
1	4.0	15.000	60.00	304	NR2	5.44
2	3.0	10.000	42.00	304	NR2	0.26
3	3.0	10.000	42.00	304	NR2	0.65
4	4.0	12.000	42.00	304	NR1.5	0.83
Top pressure						13184.0
Total Pressure Drop						8.65

Design Notes: === REJ CASE-80° @ 255 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....n\T501_REJ-80° sul

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Page 1 of 4

FINAL COPY

Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 1 / 2 / 3

	Section 1 TOP SECTION	Section 2 UPPER MIDDLE SECTION	Section 3 LOWER MIDDLE SECTION
Geometry Data:			
Geometry:	B1_NR2	B2_NR2	B3_NR2
Packing Type:	NR2	NR2	NR2
Material:	304	304	304
Column Diameter [in]:	60.00	42.00	42.00
Packing height [ft]:	15.000	10.000	10.000
NTS:	4.0	3.0	3.0
HETP [in]:	45	40	40
Sheet Thickness [in]:	0.0157	0.0157	0.0157
Dry Weight [lb]:	2647.66	864.90	864.90

Fluid Data:

	Top	Btm	Top	Btm	Top	Btm
Gas:						
Mult. Vapor Rate [lb/h]:	98770.0	96460.0	10480.0	14700.0	15630.0	19540.0
Density [lb/ft³]:	1.3710	1.3200	1.4990	1.6670	1.8890	1.9840
Viscosity [cP]:	0.0086	0.0088	0.0095	0.0097	0.0097	0.0098
QV [cfs]:	20.01	20.30	1.94	2.45	2.30	2.74
Liquid:						
Mult. Liquid Rate [lb/h]:	12980.0	9927.0	17830.0	22050.0	36410.0	40320.0
Density [lb/ft³]:	27.16	33.04	33.73	30.81	31.55	30.21
Surface Tension [dyne/cm]:	7.31	11.66	12.05	7.66	7.67	5.85
Viscosity [cP]:	0.083	0.139	0.151	0.103	0.111	0.096
QL [gpm]:	59.58	37.46	65.90	89.23	143.88	166.40
System Factor:	0.90	0.90	0.90	0.90	1.00	1.00

Calculated Output:

Capacity [%]:	66.2	56.9	21.2	29.3	31.2	37.9
F-Factor [US]:	1.19	1.19	0.25	0.33	0.33	0.40
Spec. liquid load [gpm/ft²]:	3.03	1.91	6.85	9.28	14.96	17.30
Pressure drop [in w./ft]:	0.24	0.14	0.01	0.02	0.02	0.05
Flow Parameter:	0.030	0.021	0.359	0.349	0.570	0.529
Liquid Holdup [%]:	1.1		2.2		3.2	
Bed pressure drop [mmHg]:	5.44		0.26		0.65	

Design Notes: === REJ CASE-80° @ 255 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....\T501-REJ-80°sulf

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Page 2 of 4

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 4

Section 4
BOTTOM SECTION

Geometry Data:

Geometry:	B4_NR1.5
Packing Type:	NR1.5
Material:	304
Column Diameter [in]:	42.00
Packing height [ft]:	12.000
NTS:	4.0
HETP [in]:	36
Sheet Thickness [in]:	0.0157
Dry Weight [lb]:	1304.56

Fluid Data:

	Top	Btm
Gas:		
Mult. Vapor Rate [lb/h]:	14850.0	16570.0
Density [lb/ft³]:	1.9990	2.1510
Viscosity [cP]:	0.0098	0.0103
QV [cfs]:	2.06	2.14
Liquid:		
Mult. Liquid Rate [lb/h]:	35630.0	37360.0
Density [lb/ft³]:	30.34	30.27
Surface Tension [dyne/cm]:	5.79	5.56
Viscosity [cP]:	0.097	0.093
QL [gpm]:	146.41	153.88
System Factor:	1.00	1.00

Calculated Output:

Capacity [%]:	33.7	36.0
F-Factor [US]:	0.30	0.33
Spec. liquid load [gpm/ft²]:	15.22	16.00
Pressure drop [in w./ft]:	0.03	0.04
Flow Parameter:	0.616	0.601
 Liquid Holdup [%]:	 3.8	
Bed pressure drop [mmHg]:	0.83	

Design Notes: === REJ CASE-80° @ 255 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....\T501 REJ 80° Sul

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FINAL COPY

Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

INTERNALS Section 1 - 4**Section 1****Distributor**

Type: **VSIR**
 d_hole [in]: **0.2**
 Height [in]: **29**
 Material: **1.4307**
 Weight [lb]: **642**
 DPD [1/ft²]: **7.43**
 Holdup [ft³]: **39.906**
 Quality: **g**
 Beams:
 LSL [%]: **50**
 Bm.type:
 Range [%]: **30-120**
 dp [mmHg]: **1.05**
 Range [gpm]: **17.88-71.50**
 LSL [gpm]: **29.79**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **60.351**
 Weight [lb]: **302**
 Holdup [ft³]: **5.121**
 dp [mmHg]: **0.038**
 Cost-F.: **1.0**

Support

Type: **GIS**
 Material: **1.4307**
 Height [in]: **12**
 Weight [lb]: **161**
 Cost-F.: **1.0**

Section 2**Distributor**

Type: **VSIR**
 d_hole [in]: **0.2**
 Height [in]: **29**
 Material: **1.4307**
 Weight [lb]: **298**
 DPD [1/ft²]: **7.43**
 Holdup [ft³]: **19.423**
 Quality: **g**
 Beams:
 LSL [%]: **50**
 Bm.type:
 Range [%]: **30-120**
 dp [mmHg]: **0.05**
 Range [gpm]: **19.77-79.09**
 LSL [gpm]: **32.95**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.053**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Section 3**Distributor**

Type: **VSIR**
 d_hole [in]: **0.4**
 Height [in]: **28**
 Material: **1.4307**
 Weight [lb]: **295**
 DPD [1/ft²]: **7.43**
 Holdup [ft³]: **19.070**
 Quality: **g**
 Beams:
 LSL [%]: **50**
 Bm.type:
 Range [%]: **30-120**
 dp [mmHg]: **0.08**
 Range [gpm]: **43.16-172.66**
 LSL [gpm]: **71.94**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.079**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Section 4**Distributor**

Type: **VSIR**
 d_hole [in]: **0.4**
 Height [in]: **28**
 Material: **1.4307**
 Weight [lb]: **295**
 DPD [1/ft²]: **7.43**
 Holdup [ft³]: **19.070**
 Quality: **g**
 Beams:
 LSL [%]: **50**
 Bm.type:
 Range [%]: **30-120**
 dp [mmHg]: **0.07**
 Range [gpm]: **43.92-175.70**
 LSL [gpm]: **73.21**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.053**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Design Notes: === REJ CASE-80° @ 255 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....\T501_REJ-80°_sul

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Page 4 of 4

Note: See the VSIR / SKG summary.

FINAL COPY

Reference: 7120054 J258-18
Customer: THOMAS RUSSELL CO.
Service: DEMETHANIZER
Item: 1 T-501
Date Run: 5-Aug-2011

SUMMARY T-501 DEMETHANIZER

Section	NTS	Height [ft]	Diameter [in]	Material	Product	Pressure drop [mmHg]
1	4.0	15.000	60.00	304	NR2	6.11
2	3.0	10.000	42.00	304	NR2	2.56
3	3.0	10.000	42.00	304	NR2	4.58
4	4.0	12.000	42.00	304	NR1.5	6.05
Top pressure						10857.0
Total Pressure Drop						22.93



7120054 05-Aug-2011

Design Notes: === REJ CASE-SC6-HD5 @ 210 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....01_REJ-SC6-HD5.su1

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 1 / 2 / 3

	Section 1 TOP SECTION	Section 2 UPPER MIDDLE SECTION	Section 3 LOWER MIDDLE SECTION
Geometry Data:			
Geometry:	B1_NR2	B2_NR2	B3_NR2
Packing Type:	NR2	NR2	NR2
Material:	304	304	304
Column Diameter [in]:	60.00	42.00	42.00
Packing height [ft]:	15.000	10.000	10.000
NTS:	4.0	3.0	3.0
HETP [in]:	45	40	40
Sheet Thickness [in]:	0.0157	0.0157	0.0157
Dry Weight [lb]:	2647.66	864.90	864.90

Fluid Data:

	Top	Btm	Top	Btm	Top	Btm
Gas:						
Mult. Vapor Rate [lb/h]:	97880.0	96690.0	31260.0	36500.0	34620.0	40840.0
Density [lb/ft ³]:	1.1510	1.1260	1.3430	1.4000	1.5790	1.6840
Viscosity [cP]:	0.0085	0.0086	0.0090	0.0092	0.0092	0.0095
QV [cfs]:	23.62	23.85	6.47	7.24	6.09	6.74
Liquid:						
Mult. Liquid Rate [lb/h]:	17120.0	17520.0	30630.0	35870.0	59460.0	65680.0
Density [lb/ft ³]:	28.99	31.71	32.33	30.46	31.40	30.65
Surface Tension [dyne/cm]:	9.19	10.74	11.09	7.76	8.05	6.54
Viscosity [cP]:	0.104	0.121	0.128	0.101	0.110	0.100
QL [gpm]:	73.63	68.88	118.12	146.82	236.09	267.17
System Factor:	0.90	0.90	0.90	0.90	1.00	1.00

Calculated Output:

Capacity [%]:	70.4	66.9	56.9	68.2	65.3	75.1
F-Factor [US]:	1.29	1.29	0.78	0.89	0.80	0.91
Spec. liquid load [gpm/ft ²]:	3.75	3.51	12.28	15.26	24.54	27.77
Pressure drop [in w./ft]:	0.24	0.20	0.09	0.18	0.17	0.32
Flow Parameter:	0.035	0.034	0.200	0.211	0.385	0.377
Liquid Holdup [%]:	1.4		3.0		4.4	
Bed pressure drop [mmHg]:	6.11		2.56		4.58	

Design Notes: === REJ CASE-SC6-HD5 @ 210 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa....01_REJ-SC6-HD5.sult

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Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

PACKING DESIGN Section 4

Section 4
BOTTOM SECTION

Geometry Data:

Geometry:	B4_NR1.5
Packing Type:	NR1.5
Material:	304
Column Diameter [in]:	42.00
Packing height [ft]:	12.000
NTS:	4.0
HETP [in]:	36
Sheet Thickness [in]:	0.0157
Dry Weight [lb]:	1304.56

Fluid Data:

	Top	Btm
Gas:		
Mult. Vapor Rate [lb/h]:	30990.0	37920.0
Density [lb/ft ³]:	1.7520	1.9670
Viscosity [cP]:	0.0096	0.0099
QV [cfs]:	4.91	5.36
Liquid:		
Mult. Liquid Rate [lb/h]:	55830.0	62760.0
Density [lb/ft ³]:	30.75	30.18
Surface Tension [dyne/cm]:	6.37	5.56
Viscosity [cP]:	0.100	0.094
QL [gpm]:	226.36	259.27
System Factor:	1.00	1.00

Calculated Output:

Capacity [%]:	64.5	75.1
F-Factor [US]:	0.68	0.78
Spec. liquid load [gpm/ft ²]:	23.53	26.95
Pressure drop [in w./ft]:	0.19	0.35
Flow Parameter:	0.430	0.423
 Liquid Holdup [%]:	 5.1	
Bed pressure drop [mmHg]:	6.05	

Design Notes: === REJ CASE-SC6-HD5 @ 210 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa...01_REJ-SC6-HD5.suit

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FINAL COPY

Reference: 7120054 J258-18
 Customer: THOMAS RUSSELL CO.
 Service: DEMETHANIZER
 Item: 1 T-501
 Date Run: 5-Aug-2011

INTERNALS Section 1 - 4**Section 1****Distributor**

Type: **VSIR**
 d_hole [in]: **0.2**
 Height [in]: **28**
 Weight [lb]: **631**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **22.09-88.35**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **60.351**
 Weight [lb]: **302**
 Holdup [ft³]: **5.121**
 dp [mmHg]: **0.045**
 Cost-F.: **1.0**

Support

Type: **GIS**
 Material: **1.4307**
 Height [in]: **12**
 Weight [lb]: **161**
 Cost-F.: **1.0**

Section 2**Distributor**

Type: **VSIR**
 d_hole [in]: **0.3**
 Height [in]: **28**
 Weight [lb]: **293**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **35.44-141.75**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.393**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Section 3**Distributor**

Type: **VSIR**
 d_hole [in]: **0.5**
 Height [in]: **28**
 Weight [lb]: **295**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **70.83-283.31**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.409**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Section 4**Distributor**

Type: **VSIR**
 d_hole [in]: **0.5**
 Height [in]: **28**
 Weight [lb]: **293**
 DPD [1/ft²]: **7.43**
 Quality: **g**
 LSL [%]: **50**
 Range [%]: **30-120**
 Range [gpm]: **67.91-271.64**
 Cost-F.: **1.0**

Collector

Type: **SK**
 Material: **1.4307**
 Height [in]: **12**
 A-free [%]: **15.000**
 Weight [lb]: **190**
 Holdup [ft³]: **5.368**
 dp [mmHg]: **0.302**
 Cost-F.: **1.0**

Support

Type: **EMS**
 Material: **1.4307**
 Height [in]: **4**
 Weight [lb]: **79**
 Cost-F.: **1.0**

Design Notes: === REJ CASE-SC6-HD5 @ 210 PSIA ===

Engineer Name: GHS

File: S:\Proposals\ChemGa...01_REJ-SC6-HD5.su1

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Page 4 of 4

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Note: See the VSIR & SKG Summary

Section 3

Material Test Reports



MTR'S

Client / Cliente: UOP RUSSELL, LLC.

Column / Columna:

CTUS No

CTMX Ref. No.

T-501

9033982-02

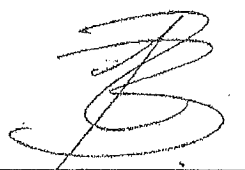
9033982-02

DEMETHANIZER

DESCRIPTION DESCRIPCIÓN	TYPE TIPO	HT COLADA	PAGE PAGINA
Sheet Ga.10	304L	512465	1
Sheet Ga.10	304L	21503099	2
Sheet Ga.12	304L	508859	3
Sheet Ga.12	304L	510552	4
Sheet Ga.12	304L	511419	5
Sheet Ga.12	304L	513571	6
Sheet Ga.12	304L	089P	7
Sheet Ga.12	304L	513030	8
Sheet Ga.12	304L	510090	9
Sheet Ga.12	304L	21503099	10
Plate 1/4"	304L	512576	11
Sheet Ga.20	316L	848567	12

Juan R. Pèrez

CTP04514 Rev. 21-11-2013

Manufacturer / Fabricante outokumpu high performance stainless steel		Type of document / Tipo de documento TEST REPORT CERTIFICADO		Document number / No. Certificado JM4014		Page / página 1 / 1							
Outokumpu Mexinox S.A. de C.V. Av. Industrias No. 4100, Zona Industrial 78395 San Luis Potosí, S.L.P., México Tel. (52)(444) 826 51 00 Fax (52)(444) 826 51 89 e-mail: mexinox@outokumpu.com Internet: www.mexinox.com.mx R.F.C. TME860930HN9		Customer / Ship to / Cliente PROMOTORA INDUSTRIAL GIM/SAN LUIS											
		Customer's order number / No. de pedido cliente CS15-638											
		Mill order No. / No. de pedido 20130 - 22											
		Code part number											
		Package (Empaque) B2182216 00											
Steel grade and quality / Acero 304/ 304L UNS S30400		Product dimensions (Width /Length /Thickness) Dimensiones (Ancho / Largo /Espesor) 48.00 X COIL X .1350 1219.20 X ROLLO X 3.430				Finish / Acabado 2B							
Coil No. / Bobina No.	Heat No. / Colada	No. of pieces / Piezas	Gross WT. / Peso bruto	lb kg	Net WT. / Peso Neto	lb kg							
1	851973 00AA	512465	1	45,512 20,644	45,428 20,606								
Chemical composition / Composición Química (%)													
Heat / Colada	C	Cr	Mn	Mo	N	Ni	P	S	Si				
512465	.0220	18.1600	1.2900	.2500	.0680	8.0000	.0260	.0010	.4100				
Heat / Colada													
Mechanical properties / Propiedades mecánicas													
Inspection lot / Lote de inspección	D	TENSILE S. / R.TENSION (PSI/MPa)	YIELD S. / R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS HRBW								
1	B343509	T	91518 / 631	46412 / 320	54.5	81.0							
						81.0							
Inspection lot / Lote de inspección	D	TENSILE S. / R.TENSION (PSI/MPa)	YIELD S. / R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS								
THIS MATERIAL IS DFARS 225.872-1 CLAUSE COMPLIANT. MELT SOURCE: USA TEST OF INTERGRANULAR CORROSION / PRUEBA DE CORROSION INTERGRANULAR : ASTM A 262 PRACTICE A : OK. ESTE MATERIAL CUMPLE CON LA COMP.QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15b STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS : ASTM A666-15, ASME SA240-15, QQ-S-766-D, MIL-S-5059-D, AMS 5511H.													
CUMPLE CON LA NORMA "NACE STANDARD MR0103-2003" CUMPLE CON LA NORMA ASTM A-262 PRUEBAS A Y E CUMPLE CON LA NORMA "NACE STANDARD MR175"													
"ESTE MATERIAL ESTA LIBRE DE CONTAMINACION DE MERCURIO." "ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304"													
Originator of the document / Originador del documento Outokumpu Mexinox, S.A de CV An ISO 9001:2008 certified company					The information provided is a true copy of data on file/ Los valores mostrados corresponden a los datos archivados								
 We hereby certify that in recognition of the terms and conditions set forth in the EU RoHS2 Directive -2011/65/EU, we can insure that all of our products and processes fully comply with it. HECHO EN USA / MADE IN USA					 José Luis Rodríguez Govea EN 10204 3.1 Name of expert / Nombre del experto								
Certificate is generated automatically / Certificado generado automáticamente					Date of issue and validation Fecha de emisión y validación 24-NOV-16 IMPRESO 14:26:39 08-DIC-16								



A-152-16

A-152-16

MILL TEST CERTIFICATE
(INSPECTION CERTIFICATE)

In Accordance with EN 10204 :2004 Type 3.1

Jindal Stainless Limited.
Jajpur, Odisha

CUSTOMER	:EXCEL STAINLESS LLC	CERTIFICATE NO.	:JSL-JRD/QA/2015-16/EXP/00014666
CITY	:Warrenville IL	DATE	:04.01.2016
OA NO	:26039	NET WT(MT)	:18.375
SALES ORDER NO.	:0568000168	COMMERCIAL INV. NO.	:7463
PROFORMA INVOICE NO.	:6130000412	OA DATE:09.11.2015	SO DATE:09.11.2015
		DATE:04.01.2016	

Material Description/Product COLD ROLLED ANNEALED PICKLED STAINLESS STEEL SHEETS	Material Specifications ASTM A240/A240M-15, ASME SA-240/SA-240M 2013 SEC. II, PART A	Process-Route EAF-AOD-LRF-CCS	Dimension Tolerance specification As per QA/PO Agreement.
--	--	----------------------------------	--

PHYSICAL DESCRIPTION

SR NO	BATCH NO	PARENT COIL NO./PLATE NO.	PKT/PALLET NO	WEIGHT (MT)	NO OF PCS	HEAT NO	GRADE	THK (inch)	WIDTH (inch)	LENGTH (inch)	FINISH	EDGE	QUALITY
1	D021660901	0000174427	D021660901	1.670	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME
2	D021660902	0000174427	D021660902	1.666	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME
3	D021660903	0000174427	D021660903	1.677	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME
4	D021660904	0000174427	D021660904	1.661	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME
5	D021660905	0000174427	D021660905	1.677	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME
6	D021660906	0000174427	D021660906	1.672	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME
7	D021660907	0000174427	D021660907	1.670	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME
8	D021660908	0000174427	D021660908	1.672	11	21503099	304L	0.1350	60.00	144	2B	TE	PRIME

CHEMICAL ANALYSIS (LADLE)

SR NO.	HEAT NO	GRADE	C%	Mn%	S%	P%	Si%	Ni%	Cr%	N%	Mo%	Cu%	Ti%	Nb/Cb%	Al%
1	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
2	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
3	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
4	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
5	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
6	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
7	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
8	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					

MECHANICAL PROPERTIES: SAMPLE DIRECTION - TRANSVERSE

Sr No.	Batch No.	Thk Inch	Rp 0.2/YS Mpa	Rp 1.0 Mpa	Rm/TS Mpa	%EL A 50 mm	%EL 5.65x SR CG mm	Hardness HRB	Bend Test 180°	1)-MATERIAL SOLUTION ANNEALED IN ACCORDANCE WITH REQUIREMENT AS LAID IN ASTM A480/A480M-14 // ASME SA-480/SA-480M 2013 SEC II, PART A "TABLE A1.2.
1	D021660901	0.135	347	630	55	82 / 83				2)-SURFACE FINISH AS PER ASTM A480/A480M-14 // ASME SA-480/SA-480M 2013 SEC II, PART A 2B ON BOTH SIDE.
2	D021660902	0.135	347	630	55	82 / 83				3)-MARKING:- COMPANY NAME, COIL NO, HEAT NO, GRADE, SIZE, FINISH.
3	D021660903	0.135	347	630	55	82 / 83				4)-IGC TEST AS PER ASTM A262-14 PRACTICE "E" & AFTER EXPOSURE THE SPECIMENS WERE BENT (It : 180°) AND INSPECTED AT MAGNIFICATION OF 20X & FOUND WITHOUT ANY CRACKS.
4	D021660904	0.135	347	630	55	82 / 83				5)-MATERIALS CONFORM TO REQUIREMENT AS PER NACE MR0175 & NACE MR0103.
5	D021660905	0.135	347	630	55	82 / 83				
6	D021660906	0.135	347	630	55	82 / 83				
7	D021660907	0.135	347	630	55	82 / 83				
8	D021660908	0.135	347	630	55	82 / 83				

The material supplied under this Test Certificate is free from any radioactive contamination as checked by procedures established by Jindal Stainless Limited as per the recommendations provided by AERB.

Jindal Stainless Limited,
Kalinga Nagar Industrial Complex,
PO: Durgapali, Jajpur
Odisha - 755026, India
TEL: +91-6726-266006,
FAX: +91-1662-220496, 220476
Email: QualityMTC@jrd.jindalsteel.com
Form Ref: JSLO/FOA/CRM/33

This is hereby certified that the material was manufactured, sampled, tested & inspected in accordance with requirements of the material specification and has been found to meet the requirements of order.

QMS:ISO 9001:2008
EN:ISO 14001:2004
OHSAS:18001:2007
CERTIFIED COMPANY

Documents Digitally signed by Jindal Stainless Limited

Manojita Patra
05 April 2016 16:18

Any unauthorised usage of this Test Certificate will warrant Legal Action.

2

A-157-16

PT16356 CUPRUM



Outokumpu Mexinox, S.A. de C.V.

TEST REPORT (CERTIFICADO)

CUSTOMER (CLIENTE)

CUPRUM METALES LAMINADOS SA DE

MILL ORDER No. No. DE PEDIDO	16455 - 25	PACKAGE (EMPAQUE) No. B0040316	00
CUSTOMER PURCHASE ORDER No.	GL2090	DATE (FECHA)	11-ENE-16
CODE PART NUMBER		REPORT (CERTIFICADO) No.	IW7571

PRODUCT IDENTIFICATION
IDENTIFICACION DEL PRODUCTO

ITEM No.	COIL No. No. DE ROLLO	PIECES PIEZAS	HEAT COLADA No.	TYPE AND FINISH TIPO Y ACABADO	DIMENSIONS DIMENSIONES	GROSS WT. PESO BRUTO	NET WT. PESO NETO
1	493578 00CA	1	508859	304L/ 2B UNS S30403	48.00 X COIL X .1051 1219.20 X ROLLO X 2.670	10.177 4.616	10.084 4.574

CHEMICAL COMPOSITION
COMPOSICION QUIMICA (%)

ITEM	C	Cr	Mn	N	Ni	P	S	Si	OTHER ELEMENTS (OTROS ELEMENTOS)
1	.0290	18.1900	1.3500	.0800	8.0400	.0280	.0010	.3600	

MECHANICAL PROPERTIES
PROPIEDADES MECANICAS

ITEM No.	TEST No. No. MUESTRA	D	TENSILE S. R. TENSION	YIELD S. R. FLUENCIA (OFFSET 0.20%)	ELONGATION % ALARGAMIENTO	HARDNESS DUREZA HRBW
1	B274847 B274812	L	90648 psi 625 MPa	49747 psi 343 MPa	57.8	(PUNTA / COLA) 86.0 / 85.0

ORIGEN COLADA: USA

ESTE MATERIAL CUMPLE CON LA COMP. QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15 STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS :
ASTM A666-10, ASME SA240-11, QQ-S-766-D, MIL-S-5059-D,
AMS 5511H,

ESTE MATERIAL CUMPLE CON LA COMPOSICION QUIMICA DE 304/304L

"ESTE MATERIAL ESTA LIBRE DE CONTAMINACION DE MERCURIO." "ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304"

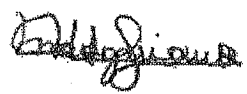
® We hereby certify that in recognition of the terms and conditions set forth in the EU RoHS2 Directive -2011/65/EU, we can insure that all of our products and processes fully comply with it.

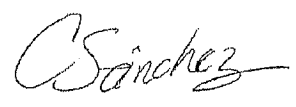
OUTOKUMPU
ACERO INOXIDABLEELABORADO POR
Noe Angulano Hernandez

HECHO EN MEXICO / MADE IN MEXICO

IMPRESO: 18-24-19 02-MAR-16

FORMATO No. 39 - 027 - 92 Rev. 2

Manufacturer / Fabricante outokumpu high performance stainless steel 		Type of document / Tipo de documento TEST REPORT CERTIFICADO		Document number / No. Certificado JE0315		Page / pagina 1 / 1											
Outokumpu Mexinox S.A. de C.V. Av. Industrias No. 4100, Zona Industrial 78395 San Luis Potosí, S.L.P., México Tel. (52)(444) 826 51 00 Fax (52)(444) 826 51 69 e-mail:mexinox@outokumpu.com Internet: www.mexinox.com.mx R.F.C. TME860930HN9		Customer / Ship to / Cliente SULZER CHEMTECH, S. DE R.L. DE C.V.															
		Customer's order number / No. de pedido cliente															
		Mill order No. / No. de pedido		18012 - 4													
		Code part number															
Steel grade and quality / Acero		Product dimensions (Width /Length /Thickness) Dimensiones (Ancho / Largo /Espesor)				in mm		Finish / Acabado									
304L UNS S30403		48.00 X 144.00 X .1051 1219.20 X 3657.60 X 2.670						2B									
Coil No. / Bobina No		Heat No. / Colada		No. of pieces / Piezas		Gross WT. lb Peso bruto kg		Net WT. lb Peso Neto kg									
1 495171 AFAA		510552		10		2,253 1,022		2,033 922									
Chemical composition / Composición Química (%)																	
Heat / Colada		C	Cr	Mn	N	Ni	P	S	Si								
510552		.0260	18.0200	1.3500	.0620	8.0500	.0250	.0010	.3900								
Heat / Colada																	
Mechanical properties / Propiedades mecánicas																	
Inspection lot / Lote de inspeccion		D	TENSILE S./ R.TENSION (PSI/MPa)		YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)		ELONGACION % ALARGAMIENTO		HARDNESS HRBW								
1 B307758		T	92099 / 635		41045 / 283		57.6		83.0								
									83.0								
Inspection lot / Lote de inspeccio		D	TENSILE S./ R.TENSION (PSI/MPa)		YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)		ELONGACION % ALARGAMIENTO		HARDNESS								
THIS MATERIAL IS DFARS 225.872-1 CLAUSE COMPLIANT. MELT SOURCE: USA																	
ESTE MATERIAL CUMPLE CON LA COMP.QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15b STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS : ASTM A66615, ASME SA240-16a, QQ-S-766-D, MIL-S-5059-D, AMS 5511H,																	
CUMPLE CON LA NORMA "NACE STANDARD MR175" PROVISTA POR EL CLIENTE. CUMPLE CON NORMA ASTM A-262 PRUEBAS "A" y "E"																	
"ESTE MATERIAL ESTA LIBRE DE CONTAMINACION DE MERCURIO."ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304"																	
Originator of the document / Originador del documento Outokumpu Mexinox, S.A de CV An ISO 9001:2008 certified company										The information provided is a true copy of data on file/ Los valores mostrados corresponden a los datos archivados 					Date of issue and validation Fecha de emisión y validación 12-JUN-16		
 mexinox ACERO INOXIDABLE										We hereby certify that in recognition of the terms and conditions set forth in the EU RoHS2 Directive -2011/65/EU, we can insure that all of our products and processes fully comply with it . HECHO EN MEXICO / MADE IN MEXICO					IMPRESO 17:59:46 28-JUN-16		
Certificate is generated automatically / Certificado generado automaticamente										Noé Anguitano Hernández EN 10204 3.1 Name of expert / Nombre del experto							

Manufacturer / Fabricante outokumpu high performance stainless steel		Type of document / Tipo de documento TEST REPORT CERTIFICADO		Document number / No. Certificado JI1097		Page / pagina 1 / 1								
Outokumpu Mexinox S.A. de C.V. Av. Industrias No. 4100, Zona Industrial 78395 San Luis Potosí, S.L.P., México Tel. (52)(444) 826 51 00 Fax (52)(444) 826 51 69 e-mail: mexinox@outokumpu.com Internet: www.mexinox.com.mx R.F.C. TME860930HN9		Customer / Ship to / Cliente		SULZER CHEMTECH, S. DE R.L. DE C.V.										
		Customer's order number / No. de pedido cliente		PT00016961										
		Mill order No. / No. de pedido		19063 - 2										
		Code part number												
		Package (Empaque)		H6697816 00										
Steel grade and quality / Acero		Product dimensions (Width /Length /Thickness) Dimensiones (Ancho / Largo /Espesor)				Finish / Acabado								
304L UNS S30403		48.00 X 144.00 X .1051 1219.20 X 3657.60 X 2.670				2B								
Coil No. / Bobina No	Heat No. / Colada	No. of pieces / Piezas	Gross WT. Peso bruto	lb kg	Net WT. Peso Neto	lb kg								
1 495958 AAAG	511419	20	4,361 1,978		4,118 1,868									
Chemical composition / Composición Química (%)														
Heat / Colada	C	Cr	Mn	N	Ni	P	S	Si						
511419	.0230	18.0600	1.3100	.0610	8.3300	.0270	.0040	.3600						
Heat / Colada														
Mechanical properties / Propiedades mecánicas														
Inspection lot / Lote de inspeccion	D	TENSILE S./ R.TENSION (PSI/MPa)	YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS HRBW									
1 B327092	T	92389 / 637	44091 / 304	57.0	85.0									
					85.0									
Inspection lot / Lote de inspeccion	D	TENSILE S./ R.TENSION (PSI/MPa)	YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS									
THIS MATERIAL IS DFARS 225.872-1 CLAUSE COMPLIANT. MELT SOURCE: USA ESTE MATERIAL CUMPLE CON LA COMP.QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15b STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS : ASTM A666-15, ASME SA240-15, QQ-S-766-D, MIL-S-5059-D, AMS 5511H, CUMPLE CON LA NORMA "NACE STANDARD MR175" PROVISTA POR EL CLIENTE. CUMPLE CON NORMA ASTM A-262 PRUEBAS "A" y "B" "ESTE MATERIAL ESTA LIBRE DE CONTAMINACION DE MERCURIO." "ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304"														
Originator of the document / Originador del documento Outokumpu Mexinox, S.A de CV An ISO 9001:2008 certified company					The information provided is a true copy of data on file/ Los valores mostrados corresponden a los datos archivados									
 We hereby certify that in recognition of the terms and conditions set forth in the EU RoHS2 Directive -2011/65/EU, we can insure that all of our products and processes fully comply with it . HECHO EN MEXICO / MADE IN MEXICO					 Carlos Armando Sanchez Burgos EN 10204 3.1 Name of expert / Nombre del experto									
Certificate is generated automatically / Certificado generado automaticamente					Date of issue and validation Fecha de emisión y validación 29-AGO-16 IMPRESO 19:50:35 26-SEP-16									

Manufacturer / Fabricante  high performance stainless steel		Type of document / Tipo de documento TEST REPORT CERTIFICADO		Document number / No. Certificado JP1042		Page / página 1 / 1		
Outokumpu Mexinox S.A. de C.V. Av. Industrias No. 4100, Zona Industrial 78395 San Luis Potosí, S.L.P., México Tel. (52)(444) 826 51 00 Fax (52)(444) 826 51 69 e-mail: mexinox@outokumpu.com Internet: www.mexinox.com.mx R.F.C. TME860930HN9		Customer / Ship to / Cliente CUPRUM METALES LAMINADOS SA DE C.V./SULZ						
		Customer's order number / No. de pedido cliente RMX1566						
		Mill order No. / No. de pedido 20721 - 1						
		Code part number 						
		Package (Empaque) B0167817 00						
Steel grade and quality / Acero 304L UNS S30403		Product dimensions (Width /Length /Thickness) Dimensiones (Ancho / Largo /Espesor) 48.00 X COIL X .1051 1219.20 X ROLLO X 2.670				Finish / Acabado 2B		
Coil No. / Bobina No.	Heat No. / Colada	No. of pieces / Piezas	Gross WT. / Peso bruto	lb	kg	Net WT. / Peso Neto	lb	kg
1	497302 AABA	513571	1	10,631		10,529		
			4,822			4,776		
Chemical composition / Composición Química (%)								
Heat / Colada	C	Cr	Mn	N	Ni	P	S	Si
513571	.0240	18.1700	1.3500	.0630	8.0400	.0290	.0010	.3400
Heat / Colada								
Mechanical properties / Propiedades mecánicas								
Inspection lot / Lote de inspección	D	TENSILE S./ R.TENSION (PSI/MPa)	YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS HRBW			
1	B360690	89488 / 617	41045 / 283	56.7	82.0			
					82.0			
Inspection lot / Lote de inspección	D	TENSILE S./ R.TENSION (PSI/MPa)	YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS			
ORIGEN COLADA: USA ESTE MATERIAL CUMPLE CON LA COMP.QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15b STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS: AMS 5516P, ASTM A666-15, ASME SA240-15, QQ-S-766-D, MIL-S-5059-D, AMS 5513J, AMS 5511H, *ESTE MATERIAL ESTA LIBRE DE CONTAMINACIÓN DE MERCURIO. **ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304*								
Originator of the document / Originador del documento Outokumpu Mexinox, S.A de CV An ISO 9001:2008 certified company  ACERO INOXIDABLE HECHO EN MEXICO / MADE IN MEXICO Certificate is generated automatically / Certificado generado automáticamente					The information provided is a true copy of data on file/ Los valores mostrados corresponden a los datos archivados  Noe Anguiano Hernandez EN 10204 3.1 Name of expert / Nombre del experto		Date of issue and validation Fecha de emisión y validación 30-ENE-17 IMPRESO 15:20:17 14-MAR-17	



**NORTH AMERICAN
STAINLESS**

METALLURGICAL TEST REPORT

6870 Highway 42 East
Chent, KY 4045-9615
(502) 347-6000

Certificate: 205100 01
Customer: 0815 001

Mail To:
SAMUEL, SON & CO., INC.
2303 CENTURY CENTER BLVD.
IRVING, TX 75062

Ship To:
SAMUEL, SON & CO., INC.
2303 CENTURY CENTER BLVD.
IRVING, TX 75062

Date: 8/03/2016 Page: 2
Steel: 304/304L
Finish: 2B

Your Order: 7228532

NAS Order: AN 0714345 03

Corrosion: ASTM A262/15 A, 180Bend-OK

PRODUCT DESCRIPTION:

STAINLESS STEEL COIL, C.R. ANNEALED & PICKLED. UNS 30400/30403
ASTM A240/15B/A480/15/A666/15/ASME SA240/15, SA480/15, SA666/15
CHEM ONLY ON FOLLOWING ASTM: A276/15, A479/15, A484/15, A312/16
CHEM ONLY ON FOLLOWING ASME: SA312/13, SA479/13
AMS 5511H/5513V XMRK; MIL-5059D AMD3 (X CEN MRS); MIL-4043B
NACE MR0175/ISO 15156-3:2009 A, MR0103/07/QQ9766D-A X MAG PERM
MIN. SOLUTION ANNEAL TEMP 1900F, WATER QUENCHED

REMARKS:

Mat'l is Free of Mercury Contamination. No weld repairs.
EN 10204:2004 3.1P ROHS 1 & 2 Compliant
Material is Free of Radioactive Contamination
Steel Making Process: EAF, AOD, & Cont. Casting
Product Mfg. by a Quality Mgt. Sys. in Conf. w/ISO 9001

Product ID #	Coil #	Thickness	Width	Weight	Length	Mark	Pieces
04089P D	* 04089P D	.1050	48.0000	10,295	COIL	617.90	5 1

CHEMICAL ANALYSIS CM(Country of Mfg) ES(Spain) US(United States) ZA(South Africa) JP(Japan) Chemical Analysis per ASTM A751/14a

HEAT	CM	C %	CR %	CU %	MN %	MO %	N %	NI %	P %	S %
089P	US	.0177	18.0500	.4660	1.7620	.3000	.0765	8.0295	.0255	.0011
SI %										
.2280										

MECHANICAL PROPERTIES

Product ID #	Coil #	UTS	20C	2% YS	20C ELONG	% Hard	Tail
04089P D	04089P D	F T	90.25	42.35	51.66	84.00	83.00

WHSE 014

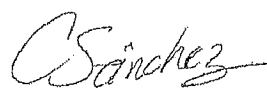
TAG M3309

NAS hereby certifies that the analysis on this certification is correct. Based upon the results and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS.

Technical
Dept. Mgr.

KRIS LARK

8/04/2016

Manufacturer / Fabricante outokumpu high performance stainless steel 		Type of document / Tipo de documento TEST REPORT CERTIFICADO		Document number / No. Certificado JN5682		Page / pagina 1 / 1					
Outokumpu Mexinox S.A. de C.V. Av. Industrias No. 4100, Zona Industrial 78395 San Luis Potosí, S.L.P., México Tel. (52)(444) 826 51 00 Fax (52)(444) 826 51 89 e-mail:mexinox@outokumpu.com internet: www.mexinox.com.mx R.F.C. TME860930HN9		Customer / Ship to / Cliente PROMOTORA INDUSTRIAL GIM/SAN LUIS									
		Customer's order number / No. de pedido cliente CS15-638									
		Mill order No. / No. de pedido 20398 - 15									
		Code part number									
		Package (Empaque) B23688 16 00									
Steel grade and quality / Acero 304L UNS S30400		Product dimensions (Width /Length /Thickness) Dimensiones (Ancho / Largo /Espesor) 48.00 X COIL X .1051 1219.20 X ROLLO X 2.670				Finish / Acabado 2B					
Coil No. / Bobina No.		Heat No. / Colada		No. of pieces / Piezas		Gross WT. / lb Peso bruto		Net WT. / lb Peso Neto			
1 497030 00AA		513030		1		39,335 17,842		39,242 17,800			
Chemical composition / Composición Química (%)											
Heat / Colada		C Cr Mn Mo N Ni P S Si									
513030		.0250 18.0700 1.3100 .3700 .0620 8.0300 .0300 .0010 .3800									
Heat / Colada											
Mechanical properties / Propiedades mecánicas											
Inspection lot / Lote de inspección		D		TENSILE S./ R.TENSION (PSI/MPa)		YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)		ELONGACION % ALARGAMIENTO		HARDNESS HIDW	
1 B352635		T		90358 / 623		41335 / 285		56.4		84.0	
										84.0	
Inspection lot / Lote de inspección		D		TENSILE S./ R.TENSION (PSI/MPa)		YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)		ELONGACION % ALARGAMIENTO		HARDNESS	
ORIGEN COLADA: USA											
ESTE MATERIAL CUMPLE CON LA COMP.QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15b STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS : ASME SA240-15, QQ-S-766-D, AMS 5513J,											
"ESTE MATERIAL ESTA LIBRE DE CONTAMINACION DE MERCURIO." "ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304"											
Originator of the document / Orighador del documento Outokumpu Mexinox, S.A de CV An ISO 9001:2008 certified company						The information provided is a true copy of data on file/ Los valores mostrados corresponden a los datos archivados					
 We hereby certify that in recognition of the terms and conditions set forth in the EU RoHS2 Directive -2011/65/EU, we can insure that all of our products and processes fully comply with it. HECHO EN MEXICO / MADE IN MEXICO						 Carlos Amando Sanchez Burgos EN 10204 3.1 Name of expert / Nombre del experto					
Certificate is generated automatically / Certificado generado automaticamente						Date of issue and validation Fecha de emisión y validación 22-DIC-16 IMPRESO 20:38:14 22-DIC-16					

A-167-16

Manufacturer / Fabricante outokumpu high performance stainless steel		Type of document / Tipo de documento TEST REPORT CERTIFICADO		Document number / No. Certificado JD6596		Page / pagina 1 / 1		
Outokumpu Mexinox S.A. de C.V. Av. Industrias No. 4100, Zona Industrial 78395 San Luis Potosí, S.L.P., México Tel. (52)(444) 826 51 00 Fax (52)(444) 826 51 69 e-mail: mexinox@outokumpu.com Internet: www.mexinox.com.mx R.F.C. TME860930HN9		Customer / Ship to / Cliente SULZER CHEMTECH, S. DE R.L. DE C.V.						
		Customer's order number / No. de pedido cliente						
		Mill order No. / No. de pedido 18012 - 4						
		Code part number						
		Package (Empaque) H4416316 00						
Steel grade and quality / Acero 304L UNS S30403		Product dimensions (Width /Length /Thickness) Dimensiones (Ancho / Largo /Espesor) 48.00 X 144.00 X .1051 1219.20 X 3657.60 X 2.670				Finish / Acabado 2B		
Coil No. / Bobina No.	Heat No. / Colada	No. of pieces / Piezas	Gross WT. / Peso bruto	lb	kg	Net WT. / Peso Neto	lb	kg
1	495005 AFAA	510090	15	3,223	1,462	3,020	1,370	
Chemical composition / Composición Química (%)								
Heat / Colada	C	Cr	Mn	N	Ni	P	S	Si
510090	.0260	18.0900	1.3100	.0690	8.0800	.0290	.0010	.3700
Heat / Colada								
Mechanical properties / Propiedades mecánicas								
Inspection lot / Lote de inspección	D	TENSILE S./ R.TENSION (PSI/MPa)	YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS HRBW			
1	B300642	T	92534 / 638	41625 / 287	59.2	83.0		
						83.0		
Inspection lot / Lote de inspección	D	TENSILE S./ R.TENSION (PSI/MPa)	YIELD S./ R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS			
THIS MATERIAL IS DFARS 225.872-1 CLAUSE COMPLIANT. MELT SOURCE: USA ESTE MATERIAL CUMPLE CON LA COMP.QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15b STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS: ASTM A66615, ASME SA240-16a, QQ-S-766-D, MIL-S-5059-D, AMS 5511H, CUMPLE CON LA NORMA "NACE STANDARD MR175" PROVISTA POR EL CLIENTE. CUMPLE CON NORMA ASTM A-262 PRUEBAS "A" y "E" "ESTE MATERIAL ESTA LIBRE DE CONTAMINACION DE MERCURIO." "ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304"								
Originator of the document / Originador del documento Outokumpu Mexinox, S.A de CV An ISO 9001:2008 certified company					The information provided is a true copy of data on file/ Los valores mostrados corresponden a los datos archivados		Date of issue and validation Fecha de emisión y validación 05-JUN-16 IMPRESO 17:58:25 28-JUN-16	
 We hereby certify that in recognition of the terms and conditions set forth in the EU RoHS2 Directive -2011/65/EU, we can insure that all of our products and processes fully comply with it. HECHO EN MEXICO / MADE IN MEXICO					Noé Anguiano Hernandez EN 10204 3.1 Name of expert / Nombre del experto			
Certificate is generated automatically / Certificado generado automáticamente								

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A-153-16

MILL TEST CERTIFICATE
(INSPECTION CERTIFICATE)
In Accordance with EN 10204 :2004 Type 3.1

Jindal Stainless Limited.
Jajpur, Odisha

CUSTOMER : EXCEL STAINLESS LLC
CITY : Warrenville IL
OA NO : 26039
SALES ORDER NO. : 0568000168
PROFORMA INVOICE NO. : 6130000476

OA DATE: 09.11.2015
SO DATE: 09.11.2015
DATE: 19.01.2016

CERTIFICATE NO. : JSL-JRD/QA/2015-16/EXP/00014801
DATE : 19.01.2016
NET WT(NT) : 34.640
COMMERCIAL INV. NO. : 7536

Material Description/Product
COLD ROLLED ANNEALED PICKLED STAINLESS STEEL SHEETS

Material Specifications
ASTM A240/A240M-15, ASME SA-240/SA-240M 2013 SEC. II, PART A

Process-Route
EAF-AOD-LRF-CCS

Dimension Tolerance specification
As per OA/PO Agreement.

PHYSICAL DESCRIPTION

SR NO	BATCH NO	PARENT COIL NO./PLATE NO.	PKT/PALLET NO	WEIGHT (MT)	NO OF PCS	HEAT NO	GRADE	THK (Inch)	WIDTH (Inch)	LENGTH (Inch)	FINISH	EDGE	QUALITY
17	F021662005	0000174419	F021662005	1.551	13	21503099	304L	0.1050	60.00	144	2B	TE	PRIME
18	F021662004	0000174419	F021662004	1.551	13	21503099	304L	0.1050	60.00	144	2B	TE	PRIME
19	F021662003	0000174419	F021662003	1.531	13	21503099	304L	0.1050	60.00	144	2B	TE	PRIME
20	F021662002	0000174419	F021662002	1.531	13	21503099	304L	0.1050	60.00	144	2B	TE	PRIME
21	F021662001	0000174419	F021662001	1.531	13	21503099	304L	0.1050	60.00	144	2B	TE	PRIME
22	D021660912	0000174427	D021660912	0.600	4	21503099	304L	0.1350	60.00	144	2B	TE	PRIME

CHEMICAL ANALYSIS (I.A.D.)

SR NO.	HEAT NO	GRADE	C%	Mn%	S%	P%	Si%	Ni%	Cr%	N%	Mo%	Cu%	Ti%	Nb/Cb%	Al%
17	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
18	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
19	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
20	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
21	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					
22	21503099	304L	0.021	1.72	0.003	0.044	0.26	8.05	18.22	0.079					

MECHANICAL PROPERTIES-SAMPLE DIRECTION - TRANSVERSE

Sr No.	Batch No.	Thk Inch	Rp 0.2/ YS Mpa	Rp 1.0 Mpa	Rm/ TS Mpa	%EL A 50 mm	%EL 5.65/ 50(CT) mm	Hardness HRC	Bend Test 180°	
17	F021662005	0.105	311		640	56		81 / 82		1)-MATERIAL SOLUTION ANNEALED IN ACCORDANCE WITH REQUIREMENT AS LAID IN ASTM A480 /A480M-14 // ASME SA-480/SA-480M 2013 SEC II, PART A "TABLE A1.2. 2)-SURFACE FINISH AS PER ASTM A480 /A480M-14 // ASME SA-480/SA-480M 2013 SEC II, PART A 2B ON BOTH SIDE. 3)-MARKING:- COMPANY NAME, COIL NO, HEAT NO, GRADE, SIZE, FINISH. 4)-IGC TEST AS PER ASTM A262-14 PRACTICE "E" & AFTER EXPOSURE THE SPECIMENS WERE BENT (1; 180°) AND INSPECTED AT MAGNIFICATION OF 20X & FOUND WITHOUT ANY CRACKS. 5)-MATERIALS CONFORM TO REQUIREMENT AS PER NACE MR0175 & NACE MR0103.
18	F021662004	0.105	311		640	56		81 / 82		
19	F021662003	0.105	311		640	56		81 / 82		
20	F021662002	0.105	311		640	56		81 / 82		
21	F021662001	0.105	311		640	56		81 / 82		
22	D021660912	0.135	347		630	55		82 / 83		

The material supplied under this Test Certificate is free from any radioactive contamination as checked by procedures established by Jindal Stainless Limited as per the recommendations provided by AERB.

Jindal Stainless Limited,
Kalinga Nagar Industrial Complex,
PO: Danegudi, Jajpur
Odisha - 755026, India.
TEL: +91-6726-266006,
FAX: +91-1662-220496, 220476
Email: QualityMTC@jrd.jindalsteel.com
Formul Ref: JSLO/FQA-CRM/33

This is hereby certified that the material was manufactured, sampled, tested & inspected in accordance with requirements of the material specification and has been found to meet the requirements of order.

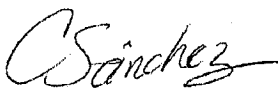
QMS:ISO 9001-2008
EMS:ISO 14001-2004
OHSAS:18001-2007
CERTIFIED COMPANY

Documents Digitally signed by Jindal Stainless Limited



Monalisa Palra
08 April 2016 16:18

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Manufacturer / Fabricante 		Type of document / Tipo de documento TEST REPORT CERTIFICADO		Document number / No. Certificado JO0619		Page / pagina 1 / 1		
Outokumpu Mexinox S.A. de C.V. Av. Industrias No. 4100, Zona Industrial 78395 San Luis Potosí, S.L.P., México Tel. (52)(444) 826 51 00 Fax (52)(444) 826 51 69 e-mail: mexinox@outokumpu.com Internet: www.mexinox.com.mx R.F.C. TME860930HN9		Customer / Ship to / Cliente CUPRUM METALES LAMINADOS SA DE C.V./SULZ						
		Customer's order number / No. de pedido cliente RMX1565						
		Mill order No. / No. de pedido 82886 - 1						
		Code part number						
		Package (Empaque) P0001117 00						
Steel grade and quality / Acero 304L UNS S30403		Product dimensions (Width /Length/Thickness) Dimensiones (Ancho / Largo /Espesor) 48.00 X 144.00 X .2500 1219.20 X 3657.60 X 6.350				Finish / Acabado 1		
Coil No. / Bobina No.	Heat No. / Colada	No. of pieces / Piezas	Gross WT. / Peso bruto	lb	kg	Net WT. / Peso Neto	lb	
1	496974 00AA	512576	7	3,594	1,630	3,404	1,544	
Chemical composition / Composición Química (%)								
Heat / Colada	C	Cr	Mn	N	Ni	P	S	
512576	.0250	18.1200	1.3100	.0620	8.0300	.0270	.0010	
Heat / Colada	Si							
	.3100							
Mechanical properties / Propiedades mecánicas								
Inspection lot / Lote de inspección	D	TENSILE S. / R.TENSION (PSI/MPa)	YIELD S. / R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS HRBW			
1	B351063	T	90648 / 625	41190 / 284	56.3	81.0		
						81.0		
Inspection lot / Lote de inspección	D	TENSILE S. / R.TENSION (PSI/MPa)	YIELD S. / R.FLUENCIA OFFSET 0.20% (PSI/MPa)	ELONGACION % ALARGAMIENTO	HARDNESS			
ORIGEN COLADA: USA ESTE MATERIAL CUMPLE CON LA COMP.QUIMICA DE ACUERDO A LA NORMA ASTM A 240/A 240M-15b STD., Y CUMPLE TAMBIEN CON LAS PROP. MECANICAS Y COMPOSICION QUIMICA ESTABLECIDAS EN LAS NORMAS : ASME SA240-15, QQ-S-766-D, AMS 5513J, "ESTE MATERIAL ESTA LIBRE DE CONTAMINACION DE MERCURIO."ESTE ANALISIS TAMBIEN REUNE LOS REQ. DEL 304"								
Originator of the document / Originador del documento Outokumpu Mexinox, S.A de CV An ISO 9001:2008 certified company 					The information provided is a true copy of data on file/ Los valores mostrados corresponden a los datos archivados 		Date of issue and validation Fecha de emisión y validación 05-ENE-17 IMPRESO 22:06:58 11-ENE-17	
We hereby certify that in recognition of the terms and conditions set forth in the EU RoHS2 Directive -2011/65/EU, we can insure that all of our products and processes fully comply with it. HECHO EN MEXICO / MADE IN MEXICO					Carlos Armando Sanchez Burgos EN 10204 3.1 Name of expert / Nombre del experto			

A-218-16



811 Regal Row
Dallas, TX 75247 United States

STANDARD CERTIFIED TEST REPORT

Page 1 of 1

Customer:

Sulzer Chemtech Mexico
Calzada La Venta No. 19
Complejo Industrial Cuamatla
Estado De Mexico, NL 54730 Mexico

Customer PO No: PT00017286

BOL #: 16950

Our Order No: 114201

Shipped Date: 9/12/2016

Material Number:	S5C316LA	316L Stainless Steel Coil	Customer Part #:	CM39999
GAUGE 0.035		FINISH 2B	Coil #:	ATI-2419-20355
GAUGE TOLERANCE +- .002		EDGE 3	LOT #:	AAB43713-B
WIDTH 19.449		DRANGE 16	Heat #:	843567
WIDTH TOLERANCE +- .005		OD 33.0	Test Report #:	TR006792
MEC ASTM A240 A480		MAX COIL WT 1100.0		
HAMPER ANNEALED		MAX SKID WT 3000.0		

Chemical Analysis (%)		Lpn	Mechanical Properties		
CARBON	.0230	AMMM334744	YLD	YIELD - KSI	42.100
MANGANESE	1.6200	AMMM334745	TEN	TENSILE - KSI	88.600
PHOSPHORUS	.0350	AMMM334746	ELO	ELONGATION - %	60.000
SULFUR	.0003	AMMM334747	HRB	HARDNESS B SCALE	78.000
SILICON	.3600	AMMM334748	HRC	HARDNESS C SCALE	
CHROMIUM	16.5500		HR30	HARDNESS 30T SCALE	
NICKEL	10.0500		HR15	HARDNESS 15T SCALE	
MOLYBDENUM	2.0400		HR45	HARDNESS 45T SCALE	
COPPER	.0000		HRV	HARDNESS VICKERS SCALE	
COBALT			BEND	BEND TEST	
TITANIUM			GRN	GRAIN SIZE	
NITROGEN	.0400		HRF	HARDNESS F SCALE	
ALUMINUM			P13	P13desc	
IRON			P14	P14desc	
ZINC			P15	P15desc	
MAGNESIUM			P16	P16desc	
NIOBIUM			P17	P17desc	
TANTALUM			Ca	Calcium	
VANADIUM			Sb	Antimony	
TIN			Li	Lithium	
LEAD			Cd	Cadmium	
BORON			As	Arsenic	
TUNGSTEN			Bi	Bismuth	
OXYGEN			EA	OTHER EACH	
PALLADIUM			TOT	OTHER TOTAL	

A minus sign in front of a value indicates that the quantity of that element is less than the amount shown

COUNTRY OF ORIGIN

USA

DFARS COMPLIANT

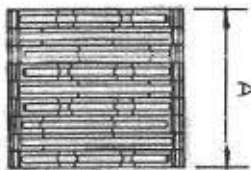
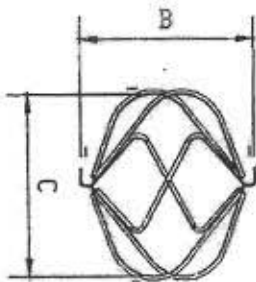
Quality Manager

12

PROCESS CONTROL : NexRing INSPECTION

DESHENG

Project : p160003094-1 Total Qty : 80m³ Heat No : 0715pox
 Type / Size : NAR#2 Package No : _____ Material : 304
 Date : 2016.12.23 Rev : 0 Date: 16/06/2015 Thickness : 0.4



Parameters/

Test sample no.

Visual	1	2	3	4	5	6	7	8	9	10
A	44.96	45.08								
B	50.62	50.50								
C	52.51	52.42								
No excessive burrs	✓	✓								
No excessive dents	✓	✓								
Production check										
QA Check										

Specification

Sizes	NexRing#0.6		NexRing#1		NexRing#1.5		NexRing#2	
Material	SS	CS	SS	CS	SS	CS	SS	CS
Mat'l Thickness	0.25	0.3	0.3	0.4	0.35	0.4	0.4	0.5
A	19.8+/-1		31.5+/-2		38+/-2		45+/-2	
B	22+/-1.5		36+/-2		43.6+/-2		51+/-2	
C	22+/-1.5		35.7+/-2		45+/-2		52+/-2	

Approved By :

X.W.M
 QA Engineer

Date :

2016.12.23

ZHEJIANG JIAXING KANGSHIDA STAINLESS STEEL CO.,LTD.

INSPECTION . CERTIFICATE 10204 3.1

Customer's Name: Sulzer Chemtech Pte Ltd

Order No: P160003094

Standard : ASTM A 240-12

Material Certificate No : K140710-02

				Weight(kg)		CHEMICAL COMPOSITION%								
No	Grade	Size (mm)	Heat No.	O.W.	Coil No.	C %	Si %	Mn %	P %	S %	Cr %	Ni %	N %	Ti
						0-0.07	0-0.75	0-2	0-0.045	0-0.003	12-18	8-10.5	0-0.1	
1	304	0.4×46	0715P04	7020	1-2	0.054	0.46	1.13	0.035	0.003	18.23	8.14	0.032	/

No	Heat No.	Yield Strength σ _{0.2} MPa ≥205	Tensile Strength σ _b MPa ≥515	Elongation % ≥40	Intergranular Attack ASTM A 262 Practice E	Hardness HB ≤201	Solution Heat Treatment ℃	Surface Quality	Dimension
	0715P04 B	330	635	52.5	/	185	1100	OK	OK
	0715P04 E	325	630	53.0	/	183	1101	OK	OK

Finish: Bright Annealed



PREPARED BY: Cao Shi Liang
Tech Manager

[Signature]

DATE: 2015-01-05

江阴市天虹金属铸造有限公司
JIANGYIN CITY TIANHONG FORGING CO.,LTD
产品质检证书
INSPECTION CERTIFICATE 3.1

电话: 0510-86236150 TEL: 0510-86236150

传真: 0510-86900613 FAX: 0510-86900613

邮编: 214423 POSTAL CODE: 214423

合同号: TH131202

证书号: TH131214-02

CONTRACT NO

CERTIFICATION NO

客户定单号:

产品名称: 热轧不锈钢带

ORDER NO

PRODUCT

标准: ASTM A240-12

牌号: 304

签发日期: 2013年12月14日

DATE OF INVOICE

交货日期: 2013年12月18日

DATE OF DELIVERY

表面精度: NO.1

SURFACE

序号	炉号	规格 (mm)	重量 (t)	化学成分 (%) Chemical Composition								
No.	Heat No.	Specification	Weight	C	Si	Mn	P	S	Cr	Ni	N	Mo
1	0715P04	3.0*1, 500	54.530	0.054	0.46	1.13	0.035	0.003	18.23	8.14	0.032	

序号	炉号	拉伸试验 Tensile Test				硬度试验	弯曲试验	晶间腐蚀
No.	Heat No.	0.2%屈服强度	抗拉强度	伸长率%	屈服延伸%	Hardness	Bend Test	Corrosion
		Y.S N/mm ²	T.S N/mm ²	EL	Y.S EL	Test HB	t	Test
1	0715P04 B	335	655	53.5		165		ok
1	0715P04 E	330	650	53.5		168		ok

1. 我们特此声明检测的样品与原产品相一致。

We hereby certify that material described herein has been manufactured and tested with satisfactory results in according with the requirement of the above material specification.

质检负责人:

Manager of quality assurance department:

2. 以上原材料都是随机抽查。

We hereby that the material described above has been detected with free irregularity.

江阴市天虹金属铸造质检中心

JIANGYIN CITY TIANHONG FORGING CENTER OF QUALITY DETECTION



PROCESS CONTROL : NexRing INSPECTION

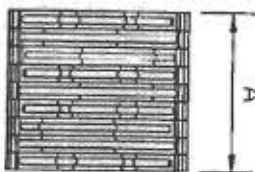
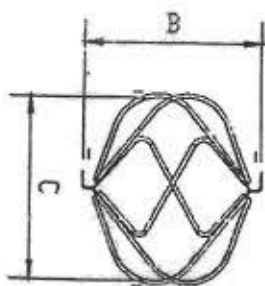
DESHENG

Project : p160003094 - 1Total Qty : 80mHeat No : 150118Type / Size : NXR#2

Package No : _____

Material : 304Date : 2016.12.24

Rev : 0 Date: 16/06/2015

Thickness : 0.4

Parameters/	Test sample no.									
Visual	1	2	3	4	5	6	7	8	9	10
A	44.86	44.74	44.92	45.04	45.10	45.06	45.12	45.01	44.98	44.91
B	50.54	50.42	50.46	50.56	50.36	50.29	50.42	50.58	50.62	50.51
C	52.40	52.38	52.46	52.52	52.56	52.60	52.41	52.51	52.54	52.62
No excessive burrs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No excessive dents	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Production check										
QA Check										

Specification

Sizes	NexRing#0.6		NexRing#1		NexRing#1.5		NexRing#2	
Material	SS	CS	SS	CS	SS	CS	SS	CS
Mat'l Thickness	0.25	0.3	0.3	0.4	0.35	0.4	0.4	0.5
A	19.8+/-1		31.5+/-2		38+/-2		45+/-2	
B	22+/-1.5		36+/-2		43.6+/-2		51+/-2	
C	22+/-1.5		35.7+/-2		45+/-2		52+/-2	

Approved By : X.W.M QA Engineer Date : 2016.12.24

Dimensions recorded are from randomly selected finish production.

ZHEJIANG JIAXING KANGSHIDA STAINLESS STEEL CO.,LTD.

INSPECTION . CERTIFICATE 10204 3.1

Customer's Name: Sulzer Chemtech Pte Ltd

Order No: P160003094

Standard : AS TMA 240-12

Material Certificate No : K150314-06

No	Grade	Size (mm)	Heat No.	Weight(kg)		CHEMICAL COMPOSITION%								
				G.W.	Coil No.	C % 0-0.07	Si % 0-0.75	Mn % 0-2	P % 0-0.045	S % 0-0.03	Cr % 17.5-19.5	Ni % 8-10.5	N % 0-0.1	Ti
1	304	0.4×45	150118	1281	1-5	0.053	0.48	1.08	0.034	0.003	18.21	8.13	0.033	/

No	Heat No.	Yield Strength σ _{0.2} MPa ≥205	Tensile Strength σ _b MPa ≥515	Elongation % ≥40	Intergranular Attack ASTMA 262 Practice E	Hardness HB ≤201	Solution Heat Treatment ℃	Surface Quality	Dimension
	150118 B	320	650	52.5	/	188	1100	OK	OK
	150118 E	315	645	52.0	/	186	1101	OK	OK

Finish: Bright Annealed



PREPARED BY: Cao Shi Liang
Tech Manager

[Signature]

DATE: 2015-11-11

江阴市天虹金属铸造有限公司
JIANGYIN CITY TIANHONG FORGING CO.,LTD
产品质检证书
INSPECTION CERTIFICATE 3.1

电话: 0510-86236150 TEL: 0510-86236150
传真: 0510-86900613 FAX: 0510-86900613

合同号: TH130302

CONTRACT NO

客户定单号:

ORDER NO

标准: ASTM A340-12

SPECIFICATION

证书号: TH130312-02

CERTIFICATION NO

产品名称: 热轧不锈钢带

PRODUCT

牌号: 304

TYPE

邮编: 214423 POSTAL CODE: 214423

签发日期: 2015年05月12日

DATE OF INVOICE

交货日期: 2015年05月14日

DATE OF DELIVERY

表面质量: NO.1

SURFACE

序号	炉号	规格 (mm)	重量 (t)	化学成分 (%) Chemical Composition									
No.	Heat No.	Specification	Weight	C	Si	Mn	P	S	Cr	Ni	N	Mo	
1	150118	3.0*1.500	35.370	0.053	0.48	1.08	0.034	0.003	18.21	8.13	0.033		

序号	炉号	拉伸试验 Tensile Test				硬度试验	弯曲试验	晶间腐蚀
		0.2%屈服强度	抗拉强度	伸长率%	断面延伸%	Hardness	Bend Test	Corrosion
No.	Heat No.	Y.S N/mm ²	T.S N/mm ²	EL	Y.S EL	Test HB	t	Test
1	150118 B	335	655	53.5		186		ok
1	150118 E	330	650	53.0		188		ok

1. 我们特此声明检测的样品与原产品相一致。

We hereby certify that material described herein has been manufactured and tested with satisfactory results in according with the requirement of the above material specification.

2. 以上原材料都是随机抽查。

We hereby that the material described above has been detected with free irregularity.

质检负责人:

Manager of quality assurance department

江阴市天虹金属铸造质检中心

JIANGYIN CITY TIANHONG FORGING CENTER OF QUALITY DETECTION



PROCESS CONTROL : NexRing INSPECTION

DESHENG

Project : P160003074 -

Total Qty : 80m³

Heat No : 150406L07

Type / Size : NAR#2

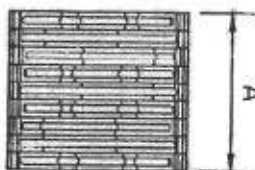
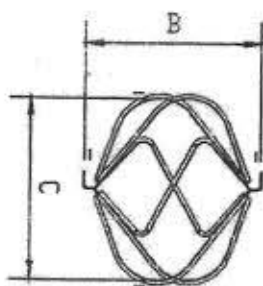
Package No :

Material : 304

Date : 2016.12.22

Rev : 0 Date: 16/06/2015

Thickness : 0.4



Parameters/	Test sample no.									
Visual	1	2	3	4	5	6	7	8	9	10
A	44.82	44.92	44.90	45.02	45.10					
B	50.47	50.52	50.62	50.42	50.58					
C	52.68	52.32	52.46	52.50	52.36					
No excessive burrs	✓	✓	✓	✓	✓					
No excessive dents	✓	✓	✓	✓	✓					
Production check										
QA Check										

Specification

Sizes	NexRing#0.6		NexRing#1		NexRing#1.5		NexRing#2	
Material	SS	CS	SS	CS	SS	CS	SS	CS
Mat'l Thickness	0.25	0.3	0.3	0.4	0.35	0.4	0.4	0.5
A	19.8+/-1		31.5+/-2		38+/-2		45+/-2	
B	22+/-1.5		36+/-2		43.6+/-2		51+/-2	
C	22+/-1.5		35.7+/-2		45+/-2		52+/-2	

Dimensions recorded are

Approved By : X.W.M QA Engineer Date : 2016.12.22
 from randomly selected for first lot of production

ZHEJIANG JIAXING KANGSHIDA STAINLESS STEEL CO.,LTD.

INSPECTION . CERTIFICATE 10204 3.1

Customer's Name: Sulzer Chemtech Pte Ltd

Order No: P160003094

Standard : ASTM A 240-12

Material Certificate No : K150610-01

No	Grade	Size (mm)	Heat No.	Weight(kg)		CHEMICAL COMPOSITION%								
				G.W.	Coil.No.	C %	Si %	Mn %	P %	S %	Cr %	Ni %	N %	Ti
1	304	0.4×45	150406L07	5673	1-1	0.051	0.48	1.04	0.034	0.004	18.22	8.13	0.033	/

No	Heat No.	Yield Strength $\sigma_{0.2}$ MPa ≥205	Tensile Strength σ_b MPa ≥515	Elongation % ≥40	Intergranular Attack ASTM A 262 Practice E	Hardness HB ≤201	Solution Heat Treatment ℃	Surface Quality	Dimension
	150406L07 B	320	625	51.5	/	182	1100	OK	OK
	150406L07 E	315	630	51.0	/	185	1101	OK	OK

Finish: Bright Annealed



PREPARED BY: Cao Shi Liang
Tech Manager

[Signature]

DATE: 2016-01-30

江阴市天虹金属铸造有限公司
JIANGYIN CITY TIANHONG FORGING CO.,LTD
产品质检证书
INSPECTION CERTIFICATE 3.1

电话: 0510-86236150 TEL: 0510-36236150

传真: 0510-86900613 FAX: 0510-86900613

邮编: 214423 POSTAL CODE: 214423

签发日期: 2015年10月14日

DATE OF INVOICE

交货日期: 2015年10月18日

DATE OF DELIVERY

表面精度: NO.1

SURFACE

合同号: TH151002

证书号: TH151014-02

CONTRACT NO

CERTIFICATION NO

客户定单号:

产品名称: 热轧不锈钢带

ORDER NO

PRODUCT

标准: ASTM A240-12

牌号: 304

SPECIFICATION

TYPE

序号	炉号	规格(mm)	重量(t)	化学成分(%) Chemical Composition									No.	
No.	Heat No.	Specification	Weight	C	Si	Mn	P	S	Cr	Ni	N			
1	150406L07	3.0*1, 500	43.540	0.051	0.48	1.04	0.034	0.004	18.22	8.13	0.033			

序号	炉号	拉伸试验 Tensile Test				硬度试验	弯曲试验	晶间腐蚀
No.	Heat No.	0.2%屈服强度	抗拉强度	伸长率%	屈服延伸%	Hardness	Bend Test	Corrosion
		Y.S N/mm ²	T.S N/mm ²	EL	Y.S EL	Test HB	t	Test
1	150406L07 B	335	665	53.0		186		ok
1	150406L07 E	340	630	52.5		185		ok

1. 我们特此声明被检测的样品与原产品相一致。

We hereby certify that material described herein has been manufactured and tested with satisfactory results in according with the requirement of the above material specification.

质检负责人:

Manager of quality assurance department

2. 以上原材料都是随机抽查。

We hereby that the material described above has been detected with free irregularity.

江阴市天虹金属铸造质检中心

JIANGYIN CITY TIANHONG FORGING CENTER OF QUALITY DETECTION



PROCESS CONTROL : NexRing INSPECTION

DESHENG

Project : p160003094-3

Total Qty : 20m

Heat No : 150:12L07

Type / Size : NXR#1

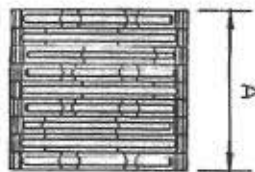
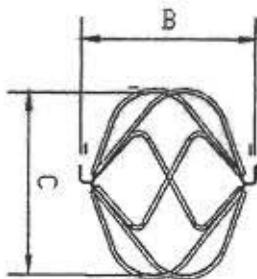
Package No :

Material : 304

Date : 2016.12.25

Rev : 0 Date: 16/06/2015

Thickness : 0.3



Parameters/	Test sample no.									
Visual	1	2	3	4	5	6	7	8	9	10
A	31.41	31.46	31.52	31.56	31.48					
B	36.17	36.02	36.10	36.08	36.01					
C	36.09	35.92	36.02	35.96	35.86					
No excessive burrs	✓	✓	✓	✓	✓					
No excessive dents	✓	✓	✓	✓	✓					
Production check										
QA Check										

Specification

Sizes	NexRing#0.6		NexRing#1		NexRing#1.5		NexRing#2		
Material	SS	CS	SS	CS	SS	CS	SS	CS	
Mat'l Thickness	0.25	0.3	0.3	0.4	0.35	0.4	0.4	0.5	
A	19.8+/-1		31.5+/-2		38+/-2		45+/-2		
B	22+/-1.5		36+/-2		43.6+/-2		51+/-2		
C	22+/-1.5		35.7+/-2		45+/-2		52+/-2		

Dimensions recorded

Approved By : X.W.M Date 2016.12.25
QA Engineer
are from randomly selected for first lot production

PROCESS CONTROL : NexRing INSPECTION

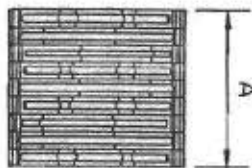
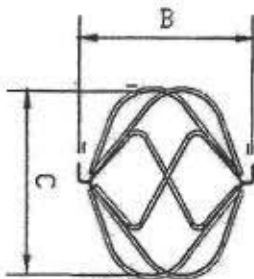
DESHENG

Project : p160003094Total Qty : 20m³Heat No : 150312607Type / Size : NXR#1

Package No : _____

Material : 304Date : 2016-12-15

Rev : 0 Date: 16/06/2015

Thickness : 0.3

Parameters/ Visual	Test sample no.									
	1	2	3	4	5	6	7	8	9	10
A	31.54	31.58	31.42	31.46	31.50					
B	36.04	35.92	35.86	36.12	35.90					
C	35.92	36.10	36.04	36.12	35.98					
No excessive burrs	✓	✓	✓	✓	✓					
No excessive dents	✓	✓	✓	✓	✓					
Production check										
QA Check										

Specification

Sizes	NexRing#0.6		NexRing#1		NexRing#1.5		NexRing#2		
Material	SS	CS	SS	CS	SS	CS	SS	CS	
Mat'l Thickness	0.25	0.3	0.3	0.4	0.35	0.4	0.4	0.5	
A	19.8+/-1		31.5+/-2		38+/-2		45+/-2		
B	22+/-1.5		36+/-2		43.6+/-2		51+/-2		
C	22+/-1.5		35.7+/-2		45+/-2		52+/-2		

Dimensions recorded

Approved By : X.W.M
QA EngineerDate : 2016-12-15

one from randomly selected finish production

ZHEJIANG JIAXING KANGSHIDA STAINLESS STEEL CO.,LTD.

INSPECTION . CERTIFICATE 10204 3.1

Customer's Name: Sulzer Chemtech Pte Ltd

Order No: P160003094

Standard : ASTM A 240-12

Material Certificate No : K150609-02

				Weight(kg)				CHEMICAL COMPOSITION%						
No	Grade	Size (mm)	Heat No.	G.W.	Coil No.	C %	Si %	Mn %	P %	S %	Cr %	Ni %	N %	Ti
						0-0.07	0-0.75	0-2	0-0.015	0-0.03	17.5-19.5	8-10.5	0-0.1	
1	304	0.30×31.5	150312L07	5831	1-2	0.054	0.42	1.03	0.035	0.003	18.21	8.15	0.033	/

No	Heat No.	Yield Strength σ _{0.2} MPa ≥205	Tensile Strength σ _b MPa ≥515	Elongation % ≥40	Intergranular Attack ASTM A 262 Practice E	Hardness HR ≤201	Solution Heat Treatment °C	Surface Quality	Dimension
	150312L07 B	325	625	51.5	/	182	1100	OK	OK
	150312L07 E	320	630	52.0	/	184	1101	OK	OK

Finish: Bright Annealed



PREPARED BY: Cao Shi Liang
Tech Manager

[Signature]

DATE: 2016-01-27

ZHEJIANG JIAXING KANGSHIDA STAINLESS STEEL CO.,LTD.

INSPECTTON . CERTIFICATE 10204 3.1

Customer's Name: Sulzer Chemtech Pte Ltd

Order No: P160003094

Standard : ASTM A 240-12
Material Certificate No : K150609-01

No	Grade	Size (mm)	Heat No.	Weight(kg)		CHEMICAL COMPOSITION%								
				G.W.	Coil.No.	C	Si	Mn	P	S	Cr	Ni	N	Ti
						% 0-0.07	% 0-0.75	% 0-2	% 0-0.045	% 0-0.03	% 17.5-19.5	% 8-10.5	% 0-0.1	
1	304	0.30×31.5	150312L07	5406	1-1	0.054	0.42	1.03	0.035	0.003	18.21	8.15	0.033	/

No	Heat No.	Yield Strength σ _{0.2} MPa ≥205	Tensile Strength σ _b MPa ≥515	Elongation % ≥40	Intergranular Attack ASTM A 262 Practice E	Hardness HB ≤201	Solution Heat Treatment ℃	Surface Quality	Dimension
	150312L07 B	320	630	51.0	/	183	1100	OK	OK
	150312L07 E	315	625	51.5	/	181	1101	OK	OK

Finish: Bright Annealed



PREPARED BY: Cao Shi Liang
Tech Manager

(Signature)

DATE: 2016-01-27

江阴市天虹金属铸造有限公司
JIANGYIN CITY TIANHONG FORGING CO.,LTD
产品质检证书
INSPECTION CERTIFICATE 3.1

电话: 0510-86236150 TEL: 0510-86236150
传真: 0510-86900613 FAX: 0510-86900613

邮编: 214423 POSTAL CODE: 214423
签发日期: 2015年10月15日
DATE OF INVOICE
交货日期: 2015年10月20日
DATE OF DELIVERY
表面精度: NO.1
-SURFACE

合同号: TH131002 证书号: TH131015-02
CONTRACT NO. CERTIFICATION NO.
客户定单号: 产品名称: 热轧不锈钢带
ORDER NO. PRODUCT
标准: ASTM A340-12 牌号: 304
SPECIFICATION TYPE

序号	炉号	规格 (mm)	重量 (t)	化学成分 (%) Chemical Composition									
No.	Heat No.	Specification	Weight	C	Si	Mn	P	S	Cr	Ni	N	Mo	
1	150312L07	3.0*1.500	50.300	0.054	0.42	1.03	0.035	0.003	18.21	8.15	0.033		

序号	炉号	拉伸试验 Tensile Test				硬度试验	弯曲试验	晶间腐蚀
		0.2%屈服强度 Y.S N/mm ²	抗拉强度 T.S N/mm ²	伸长率% EL	断面延伸% Y.S EL	Hardness Test HB	Bend Test 1	Corrosion Test
1	150312L07 B	325	635	52.5		185		ok
1	150312L07 B	320	640	53.0		183		ok

1. 我们特此声明检测的作品与产品相一致。
We hereby certify that material described herein has been manufactured and tested with satisfactory results in according with the requirement of the above material specification.

2. 以上原材料都是随机抽查。
We hereby that the material described above has been detected with free irregularity.

质检负责人:

Manager of quality assurance department



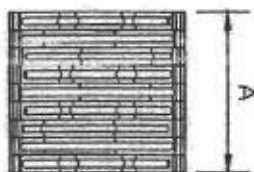
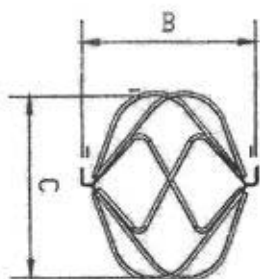
江阴市天虹金属铸造质检中心
JIANGYIN CITY TIANHONG FORGING CENTER OF QUALITY DETECTION

HT# 1615941

PROCESS CONTROL : NexRing INSPECTION

DESHENG

Project : p160003094-2 Total Qty : 2014³ Heat No : 1-15947
 Type / Size : NXR#1.5 Package No : _____ Material : 304
 Date : 2016.12.30 Rev : 0 Date:16/06/2015 Thickness : 0.35



Parameters/	Test sample nb.									
Visual	1	2	3	4	5	6	7	8	9	10
A	38.06	37.95	37.91	37.88	37.94					
B	43.15	43.22	42.98	43.06	43.04					
C	45.16	45.04	45.11	44.91	44.83					
No excessive burrs	✓	✓	✓	✓	✓					
No excessive dents	✓	✓	✓	✓	✓					
Production check										
QA Check										

Specification

Sizes	NexRing#0.6		NexRing#1		NexRing#1.5		NexRing#2	
Material	SS	CS	SS	CS	SS	CS	SS	CS
Mat'l Thickness	0.25	0.3	0.3	0.4	0.35	0.4	0.4	0.5
A	19.8+/-1		31.5+/-2		38+/-2		45+/-2	
B	22+/-1.5		36+/-2		43.6+/-2		51+/-2	
C	22+/-1.5		35.7+/-2		45+/-2		52+/-2	

Approved By : X.W.M
QA EngineerDate : 2016.12.30

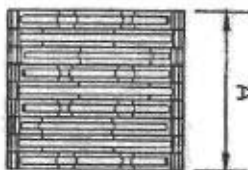
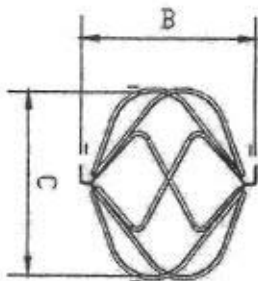
Dimensions recorded are from randomly selected finish production.

PROCESS CONTROL : NexRing INSPECTION

DESHENG

Project : p160003094Total Qty : 20m³Heat No : 1615947Type / Size : NXR#1.5Package No : Material : 304Date : 2016.12.28

Rev : 0 Date: 16/06/2015

Thickness : 0.35

Parameters/	Test sample no.									
Visual	1	2	3	4	5	6	7	8	9	10
A	38.00	38.02	37.92	37.96	38.10					
B	42.93	42.02	42.86	43.10	43.06					
C	44.67	44.72	44.62	45.02	45.10					
No excessive burrs	✓	✓	✓	✓	✓					
No excessive dents	✓	✓	✓	✓	✓					
Production check										
QA Check										

Specification

Sizes	NexRing#0.6		NexRing#1		NexRing#1.5		NexRing#2	
Material	SS	CS	SS	CS	SS	CS	SS	CS
Mat'l Thickness	0.25	0.3	0.3	0.4	0.35	0.4	0.4	0.5
A	19.8+/-1		31.5+/-2		38+/-2		45+/-2	
B	22+/-1.5		36+/-2		43.6+/-2		51+/-2	
C	22+/-1.5		35.7+/-2		45+/-2		52+/-2	

Approved By : X.W.M
QA EngineerDate : 2016-12-18

Dimensions recorded are from randomly selected for first lot production.

宁波市镇海天地特种钢有限公司
Ningbo Tiandi Special Type Steel CO.,LTD
产 品 质 检 证 书
INSPECTION CERTIFICATE EN10204 3.1

电话: 0574-86260836 TEL: 0574-86260836

传真: 0574-86260320 FAX: 0574-86260320

合同号:

CONTRACT NO

客户名称: 慈溪市天骄不锈钢管材有限公司

ORDER NO

标准: ASTM A240-12/ASME 2011A

SPECIFICATION:

证书号: T16-09-21

CERTIFICATION NO

产品名称: 热轧不锈钢钢带

PRODUCT

牌 号: 304

TYPE:

邮编: 315200 POSTAL CODE 315200

签发日期: 2016年09月29日

DATE OF INVOICE

交货日期: 2016年09月29日

DATE OF DELIVERY

表面精度: NO.1

SURFACE

序号	炉号	规格 (mm)	重量 (t)	化学成分 (%) Chemical Composition									
No.	Heat No.	Specification	Weight	C	Si	Mn	P	S	Cr	Ni	N	Mo	
1	1615941	3.0*580	33.26	0.052	0.35	0.76	0.036	0.005	18.03	8.05	0.004		
2													

序号	炉号	拉伸试验 Tensile Test				硬度试验	弯曲试验	晶间腐蚀
		0.2%屈服强度	抗拉强度	伸长率%	屈服延伸%	Hardness	Bend Test	Corrosion
		Y.S N/mm ²	T.S N/mm ²	EL	Y.S EL	Test HB	t	Test
1	1615941 B	296	601	56	/	152	/	/
1	1615941 B	298	602	64	/	153	/	/
2								
2								

1. 我们特此声明被检样品与原产品相一致。

We hereby certify that material described herein has been manufactured and tested with satisfactory results in accordance with the requirement of the above material specification.

2. 以上原材料都是随机抽查。

We hereby certify that the material described above has been detected with free irregularity.

质量技术部:

Quality and Technical Department



Section 4

Packing List

STRAIGHT BILL OF LADING - SHORT FORM - ORIGINAL - NOT NEGOTIABLE This form contains only the information necessary for the motor carrier to deliver, rate, and invoice the shipment described below.

Shipper: Ship Date 04/13/17

SULZER CHEMTECH USA INC.
1 SULZER WAY
ERIC STUBBLEFIELD
Tulsa, OK 74131
Nicole 9184456680

Carrier:	G & B Load Transport LLC
Pro #:	
Load #:	229984159
Ship ID:	9033982
PU #:	

Consignee: Due Date 04/14/17

Curtis Kelly
13863 Industrial Road
Houston, TX 77015
eric linsenbardt (713) 230-4200

All Freight charges PPD/3RD party bill to:

PPD-3RD PARTY

Agent or Cashier: Per _____ (The signature here acknowledges only the amount prepaid)	Received: \$ _____ to apply in prepayment of the charges on the property described hereon.	Charges Advanced: \$ _____
--	---	-------------------------------

Type/ Reference	SKU/UPC	Description	QTY/ UOM	Pallets	Weight	Category/ Temp	NMFC/ Class
PO #		Tower Internals	12 CRT		9,467		
			12		9,467		

Shipper Special Instructions:

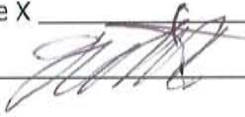
Consignee Special Instructions:

Joe Galbraith
539-664-4846 joe.galbraith@honeywell.com

Eric@curtiskellyinc.com

Comments:

The Shipper certifies that the above named materials are properly classified, described, marked, labeled, and packaged, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation.

Shipper Signature X  Date: 4-12-17 Trailer# _____
Consignee Signature X _____ Date: _____ Seal# _____
Driver Signature X  Date: _____ Seal# _____

Tulsa, Oklahoma 74131

Phone No. (918)445-6682

Reference #	9033982 /185000	Packing List By:	Mario Cacoperdo
-------------	-----------------	------------------	-----------------

918-445-6680

	HOT SHOT	If over 600 miles two drivers	
--	----------	-------------------------------	--

[illegible]

[illegible]

SHIP TO:

BWFS INDUSTRIES LLC
5637 ETHELINE
HOUSTON, TX 77039
USA

Packing List

Print Date: 03/28/2017

Cust PO: 4500755637

SULZER

Sulzer Chemtech, S de RL de CV

Calz. a la Venta No. 19

Complejo Industrial Cuamatla

Cuautitlan Izcalli

Estado de Mexico

COMP. CODE 553 54730

Phone: 52 55 50016827

Phone: 32 33 30016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH: 2140x1140x940 MM			Gross Weight: 764.00 KG
Client P.O No.		Column: T-501, Demethanizer			Net Weight: 651.00 KG
Box No.: 1					
JMX9033980-105	9033980-01-03	3-1	8	EA	PANEL INFERIOR
JMX9033980-105	9033980-01-03	3-2	8	EA	PANEL VERTICAL
JMX9033980-106	9032607-01-4	4-1-1	1	EA	ARM CHANNELS
JMX9033980-106	9032607-01-4	4-1-2	2	EA	ARM CHANNELS
JMX9033980-106	9032607-01-4	4-1-3	2	EA	ARM CHANNELS
JMX9033980-106	9032607-01-4	4-1-4	2	EA	ARM CHANNELS
JMX9033980-106	9032607-01-4	4-1-5	2	EA	ARM CHANNELS
JMX9033980-106	9032607-01-4	4-1-6	1	EA	ARM CHANNELS
JMX9033980-106	9032607-01-4	4-2-6	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-7	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-8	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-9	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-10	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-11	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-12	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-13	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-2-14	2	EA	END PANELS
JMX9033980-106	9032607-01-4	4-3	25	EA	HAT BRACKET
JMX9033980-106	9032607-01-4	4-4-15	1	EA	RISER HAT
JMX9033980-106	9032607-01-4	4-4-16	2	EA	RISER HAT
JMX9033980-106	9032607-01-4	4-4-17	2	EA	RISER HAT
JMX9033980-106	9032607-01-4	4-4-18	2	EA	RISER HAT
JMX9033980-106	9032607-01-4	4-4-19	2	EA	RISER HAT



Signature

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SULZER

Sulzer Chemtech, S de RL de CV

Calz. a la Venta No 19

Complejo Industrial Cuamatla

Cuautitlan Izcalli

Estado de Mexico

COMP. CODE 553 54730

Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH: 2780x1130x950 MM		Gross Weight: 366.00 KG	
Client P.O No.		Column: T-501, Demethanizer		Net Weight: 241.00 KG	
Box No.: 2					
JMX9033980-107	9032607-01-05	5-1-1	2	EA	RPB PANELS
JMX9033980-107	9032607-01-05	5-1-2	2	EA	RPB PANELS
JMX9033980-107	9032607-01-05	5-1-3	2	EA	RPB PANELS
JMX9033980-107	9032607-01-05	5-1-4	2	EA	RPB PANELS
JMX9033980-108	9032607-01-06	6-1-1	2	EA	GIS PANELS
JMX9033980-108	9032607-01-06	6-1-2	2	EA	GIS PANELS
JMX9033980-108	9032607-01-06	6-1-3	2	EA	GIS PANELS
JMX9033980-108	9032607-01-06	6-1-4	2	EA	GIS PANELS
JMX9033980-108	9032607-01-06	6-1-5	2	EA	GIS PANELS



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Sulzer Chemtech, S de RL de CV
Calz. a la Venta No 19
Complejo Industrial Cuamatla
Cuautitlan Izcalli
Estado de Mexico
COMP. CODE 553 54730
Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH:	2080x1140x950 MM		Gross Weight: 629.00 KG
Client P.O No.		Column: T-501, Demethanizer			Net Weight: 540.00 KG
Box No.: 3					
JMX9033980-111	9033980-01-12	12-1-1	1	EA	ARM CHANNEL
JMX9033980-111	9033980-01-12	12-1-2	2	EA	ARM CHANNEL
JMX9033980-111	9033980-01-12	12-1-3	2	EA	ARM CHANNEL
JMX9033980-111	9033980-01-12	12-1-4	2	EA	ARM CHANNEL
JMX9033980-111	9033980-01-12	12-2-1	2	EA	END PANEL
JMX9033980-111	9033980-01-12	12-2-2	2	EA	END PANEL
JMX9033980-111	9033980-01-12	12-2-3	2	EA	END PANEL
JMX9033980-111	9033980-01-12	12-2-4	2	EA	END PANEL
JMX9033980-111	9033980-01-12	12-2-5	2	EA	END PANEL
JMX9033980-111	9033980-01-12	12-2-6	2	EA	END PANEL
JMX9033980-111	9033980-01-12	12-3	24	EA	HAT BRACKET
JMX9033980-111	9033980-01-12	12-4-1	2	EA	RISER HAT
JMX9033980-111	9033980-01-12	12-4-2	2	EA	RISER HAT
JMX9033980-111	9033980-01-12	12-4-3	2	EA	RISER HAT
JMX9033980-111	9033980-01-15	15-1-1	1	EA	ARM CHANNELS
JMX9033980-111	9033980-01-15	15-1-2	2	EA	ARM CHANNELS
JMX9033980-111	9033980-01-15	15-1-3	2	EA	ARM CHANNELS
JMX9033980-111	9033980-01-15	15-1-4	2	EA	ARM CHANNELS
JMX9033980-111	9033980-01-15	15-2-6	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-2-7	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-2-8	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-2-9	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-2-10	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-2-11	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-3	24	EA	HAT BRACKET
JMX9033980-111	9033980-01-15	15-4-12	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-4-13	2	EA	END PANELS
JMX9033980-111	9033980-01-15	15-4-14	2	EA	END PANELS



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Packing List

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SULZER

Sulzer Chemtech, S de RL de CV
Calz. a la Venta No. 19
Complejo Industrial Cuamatla
Cuautitlan Izcalli,
Estado de Mexico
COMP. CODE 553 54730
Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty UM	Description
Ref No.: 9033980		Measurements LxWxH: 2080x1130x950 MM		Gross Weight: 510.00 KG
Client P.O No.		Column: T-501, Demethanizer		Net Weight: 414.00 KG
Box No.: 4				
JMX9033980-111	9032607-01-8	8-1-1	1 EA	ARM CHANNELS
JMX9033980-111	9032607-01-8	8-1-2	2 EA	ARM CHANNELS
JMX9033980-111	9032607-01-8	8-1-3	2 EA	ARM CHANNELS
JMX9033980-111	9032607-01-8	8-1-4	2 EA	ARM CHANNELS
JMX9033980-111	9032607-01-8	8-2-6	2 EA	END PANELS
JMX9033980-111	9032607-01-8	8-2-7	2 EA	END PANELS
JMX9033980-111	9032607-01-8	8-2-8	2 EA	END PANELS
JMX9033980-111	9032607-01-8	8-2-9	2 EA	END PANELS
JMX9033980-111	9032607-01-8	8-2-10	2 EA	END PANELS
JMX9033980-111	9032607-01-8	8-2-11	2 EA	END PANELS
JMX9033980-111	9032607-01-8	8-3	24 EA	HAT BRACKET
JMX9033980-111	9032607-01-8	8-4-12	2 EA	RISER HAT
JMX9033980-111	9032607-01-8	8-4-13	2 EA	RISER HAT
JMX9033980-111	9032607-01-8	8-4-14	2 EA	RISER HAT
JMX9033980-115	9032607-01-11	11-1	8 EA	SKG PANEL
JMX9033980-115	9032607-01-11	11-2	8 EA	SKG PANEL
JMX9033980-116	9032607-01-14	14-1	8 EA	SKG PANEL
JMX9033980-116	9032607-01-14	14-2	8 EA	SKG PANEL



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Sulzer Chemtech, S de RL de CV
Calz. a la Venta No 19
Complejo Industrial Cuamatla
Cuautitlan Izcalli,
Estado de Mexico
COMP. CODE 553 54730
Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH: 2080x1130x950 MM		Gross Weight: 373.00 KG	
Client P.O No.		Column: T-501, Demethanizer		Net Weight: 275.00 KG	
Box No.: 5					
JMX9033980-113	9032607-01-9	9-1-1	6	EA	RPB PANELS
JMX9033980-113	9032607-01-9	9-1-2	6	EA	RPB PANELS
JMX9033980-113	9032607-01-9	9-1-3	3	EA	RPB PANELS
JMX9033980-117	9032607-01-7	7-1-1	2	EA	DECK PANEL
JMX9033980-117	9032607-01-7	7-1-2	2	EA	DECK PANEL
JMX9033980-117	9032607-01-7	7-1-3	1	EA	DECK PANEL
JMX9033980-117	9032607-01-7	7-2-1	2	EA	RISER PANEL
JMX9033980-117	9032607-01-7	7-2-2	2	EA	RISER PANEL
JMX9033980-117	9032607-01-7	7-3-1	2	EA	RISER HAT
JMX9033980-117	9032607-01-7	7-3-2	2	EA	RISER HAT



Signature

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HOUSTON, TX 77039
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Packing List

Print Date: 03/28/2017

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SULZER

Sulzer Chemtech, S de RL de CV

Calz. a la Verita No. 19

Complejo Industrial Cuamatla

Cuautitlan Izcalli

Estado de Mexico

COMP. CODE 553 54730

Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description		
Ref No.: 9033980		Measurements LxWxH: 2080x1130x950 MM			Gross Weight: 336.00 KG		
Client P.O No.		Column: T-501, Demethanizer			Net Weight: 238.00 KG		
Box No.: 6							
JMX9033980-114	9032607-01-10	10-1-1	6	EA	GIS PANELS		
JMX9033980-114	9032607-01-10	10-1-2	6	EA	GIS PANELS		
JMX9033980-114	9032607-01-10	10-1-3	6	EA	GIS PANELS		
JMX9033980-114	9032607-01-10	10-1-4	3	EA	GIS PANELS		

Signature



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5637 ETHELINE
HOUSTON, TX 77039
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Packing List

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SULZER

Sulzer Chemtech, S de RL de CV
Calz. a la Venta No 19:
Complejo Industrial Cuamatla
Cuautlan Izcalli
Estado de Mexico
COMP. CODE 553 54730
Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH:	2070x1130x950 MM		Gross Weight: 651.00 KG
Client P.O No.		Column: T-501, Demethanizer			Net Weight: 553.00 KG
Box No.: 7					
JMX9033980-105		334	59	EA	UNIVERSAL CLAMP ONE WAY ITEM 6
JMX9033980-105		404	59	EA	CAPSCREW ITEM 7
JMX9033980-105		405	168	EA	NUT ITEM 5
JMX9033980-105		415	227	EA	WASHER ITEM 4
JMX9033980-105		419	109	EA	CAPSCREW ITEM 3
JMX9033980-106			151	EA	CAPSCREW ITEM 10
JMX9033980-106			39	EA	GASKET TEFLON .125 ITEM 11
JMX9033980-106			55	EA	STUD BOLT ITEM 8
JMX9033980-106		333	55	EA	UNIVERSAL CLAMP TWO WAY ITEM 7
JMX9033980-106		405	109	EA	NUT ITEM 9
JMX9033980-106		415	304	EA	WASHER ITEM 6
JMX9033980-106		419	99	EA	CAPSCREW ITEM 5
JMX9033980-107		307	23	EA	WASHER ITEM 5
JMX9033980-107		405	47	EA	NUT ITEM 4
JMX9033980-107		415	113	EA	WASHER ITEM 3
JMX9033980-107		419	67	EA	CAPSCREW ITEM 2
JMX9033980-108			45	EA	STUD BOLT ITEM 6
JMX9033980-108		333	45	EA	UNIVERSAL CLAMP TWO WAY ITEM 5
JMX9033980-108		405	211	EA	NUT ITEM 4
JMX9033980-108		415	290	EA	WASHER ITEM 3
JMX9033980-108		419	123	EA	CAPSCREW ITEM 2
JMX9033980-111			101	EA	CAPSCREW ITEM 10
JMX9033980-111			101	EA	CAPSCREW ITEM 10
JMX9033980-111			101	EA	CAPSCREW ITEM 10
JMX9033980-111			34	EA	STD BOLT ITEM 8
JMX9033980-111			34	EA	STD BOLT ITEM 8
JMX9033980-111			34	EA	STD BOLT ITEM 8
JMX9033980-111			51	EA	WASHER ITEM 12
JMX9033980-111			51	EA	WASHER ITEM 12
JMX9033980-111			51	EA	WASHER ITEM 12
JMX9033980-111		333	34	EA	UNIVERSAL CLAMP TWO WAY ITEM 7
JMX9033980-111		333	34	EA	UNIVERSAL CLAMP TWO WAY ITEM 7
JMX9033980-111		333	34	EA	UNIVERSAL CLAMP TWO WAY ITEM 7
JMX9033980-111		405	68	EA	NUT ITEM 9
JMX9033980-111		405	68	EA	NUT ITEM 9
JMX9033980-111		405	68	EA	NUT ITEM 9
JMX9033980-111		415	210	EA	WASHER ITEM 6



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Sulzer Chemtech, S de RL de CV
Calz. a la Venta No. 19
Complejo Industrial Cuamatla
Cuautitlan Izcalli
Estado de Mexico
COMP. CODE 553 54730
Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH:	2070x1130x950 MM		Gross Weight: 651.00 KG
Client P.O No.		Column: T-501, Demethanizer			Net Weight: 553.00 KG
Box No.: 7					
JMX9033980-111		415	210	EA	WASHER ITEM 6
JMX9033980-111		415	210	EA	WASHER ITEM 6
JMX9033980-111		419	108	EA	CAPSCREW ITEM 5
JMX9033980-111		419	108	EA	CAPSCREW ITEM 5
JMX9033980-111		419	108	EA	CAPSCREW ITEM 5
JMX9033980-113			45	EA	CAPSCREW ITEM 5
JMX9033980-113		307	45	EA	WASHER ITEM 6
JMX9033980-113		401	57	EA	CAPSCREW ITEM 2
JMX9033980-113		405	57	EA	NUT ITEM 4
JMX9033980-113		415	105	EA	WASHER ITEM 3
JMX9033980-114			87	EA	STUD BOLT ITEM 5
JMX9033980-114		333	87	EA	UNIVERSAL CLAMP TWO WAY ITEM 6
JMX9033980-114		401	165	EA	CAPSCREW ITEM 2
JMX9033980-114		405	327	EA	NUT ITEM 4
JMX9033980-114		415	411	EA	WASHER ITEM 3
JMX9033980-115		334	39	EA	UNIVERSAL CLAMP ONE WAY ITEM 6
JMX9033980-115		334	39	EA	UNIVERSAL CLAMP ONE WAY ITEM 6
JMX9033980-115		404	39	EA	CAPSCREW ITEM 7
JMX9033980-115		404	39	EA	CAPSCREW ITEM 7
JMX9033980-115		405	122	EA	NUT ITEM 5
JMX9033980-115		405	130	EA	NUT ITEM 5
JMX9033980-115		415	172	EA	WASHER ITEM 4
JMX9033980-115		415	188	EA	WASHER ITEM 4
JMX9033980-115		419	84	EA	CAPSCREW ITEM 3
JMX9033980-115		419	92	EA	CAPSCREW ITEM 3
JMX9033980-116			37	EA	STUD BOLT ITEM 7
JMX9033980-116		333	37	EA	UNIVERSAL CLAMP TWO WAY ITEM 6
JMX9033980-116		405	71	EA	NUT ITEM 8
JMX9033980-116		415	130	EA	WASHER ITEM 5
JMX9033980-116		419	95	EA	CAPSCREW ITEM 4
JMX9033980-117	9032607-01-13	13-1-1	4	EA	DECK PANEL
JMX9033980-117	9032607-01-13	13-1-2	2	EA	DECK PANEL
JMX9033980-117	9032607-01-13	13-1-3	2	EA	DECK PANEL
JMX9033980-117	9032607-01-13	13-1-4	2	EA	DECK PANEL
JMX9033980-117	9032607-01-13	13-2-1	2	EA	RISER PANEL
JMX9033980-117	9032607-01-13	13-2-2	2	EA	RISER PANEL
JMX9033980-117	9032607-01-13	13-2-3	2	EA	RISER PANEL

Signature



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Sulzer Chemtech, S de RL de CV
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Complejo Industrial Cuamatla
Cuautitlan Izcalli
Estado de Mexico
COMP. CODE 553 54730
Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH: 2070x1130x950 MM			Gross Weight: 651.00 KG
Client P.O No.		Column: T-501, Demethanizer			Net Weight: 553.00 KG
Box No.: 7					
JMX9033980-117	9032607-01-13	13-2-4	2	EA	RISER PANEL
JMX9033980-117	9032607-01-13	13-3-1	4	EA	RISER PANEL
JMX9033980-117	9032607-01-13	13-3-2	4	EA	RISER HAT
JMX9033980-117	9032607-01-13	13-4	2	EA	WALL SUMP
JMX9033980-117	9032607-01-13	13-5	2	EA	WALL SUMP
JMX9033980-117		405	8	EA	NUT ITEM 10
JMX9033980-117		415	62	EA	WASHER ITEM 7
JMX9033980-117		419	62	EA	CAPSCREW ITEM 6



Signature

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Calz. a la Venta No 19
Complejo Industrial Cuamatla
Cuautitlan Izcalli
Estado de Mexico
COMP. CODE 553 54730
Phone: 52 55 50016827

Job Order	Drawing Number	Item No.	Packed Qty	UM	Description
Ref No.: 9033980		Measurements LxWxH: 2080x820x540 MM		Gross Weight: 455.00 KG	
Client P.O No.		Column: T-501, Demethanizer		Net Weight: 399.00 KG	
Box No.: 8					
JMX9033980-109	9032607-17	17-1	12	EA	SUPPORT RING SEGMENTS
JMX9033980-109	9032607-18	18-1	20	EA	SUPPORT CLIPS
JMX9033980-110	9032607-01-16	16-1	2	EA	HORIZONTAL MEMBERS
JMX9033980-110	9032607-01-16	16-2	2	EA	VERTICAL MEMBERS
JMX9033980-118	9032607-01-20	20-1	36	EA	SUPPORT RING SEGMENTS
JMX9033980-118	9032607-01-20	21-1	36	EA	SUPPORT ANGLE
JMX9033980-118	9032607-01-23	23-1	4	EA	SUPPORT RING SEGMENTS
JMX9033980-118	9032607-01-23	23-2	4	EA	SUPPORT RING SEGMENTS
JMX9033980-118	9032607-01-23	23-3	4	EA	VERTICAL BAR
JMX9033980-118	9032607-01-23	23-4	4	EA	SUPPORT MEMBER
JMX9033980-118	9032607-01-23	23-5	2	EA	SUPPORT RING SEGMENT
JMX9033980-119	9032607-01-16	19-1	1	EA	TOP PLATE
JMX9033980-119	9032607-01-16	19-2	2	EA	VERTICAL PLATE
JMX9033980-119	9032607-01-16	19-3	1	EA	BOTTOM PLATE
JMX9033980-119	9032607-01-16	22-1	2	EA	HORIZONTAL MEBERS
JMX9033980-119	9032607-01-16	22-2	2	EA	VERTICAL MEMBERS
JMX9033980-119	9032607-01-16	24-1	4	EA	HORIZONTAL MEMBERS
JMX9033980-119	9032607-01-16	24-2	4	EA	VERTICAL MEBERS



Signature

Section 5

General Installation Instructions

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1 Introduction

We recommend that a supervisor from Sulzer is present during the installation and assembly of the Sulzer structured packings and internals, as well as during the subsequent check of the column alignment.

The supervisor from Sulzer is always to be present, if Sulzer has to give a capacity or purity guarantee. Sulzer reserves the right to reject any claims in connection with the guarantee if the installation has not been supervised by its own specialists.

Sulzer does not take over costs aroused by unqualified installation.

You must work to the specific drawings for internals and trays you are fitting. ***Ask supervisor if unsure!***

The high degree of effectiveness inherent in Sulzer columns can only be achieved when all parts are correctly installed and the following specifications are complied with.

2 GENERAL SAFETY INSTRUCTIONS

"It shall be the duty of every employee while at work - to take reasonable care for the health and safety of himself and other person who may be affected by his acts or omissions at work..."

 	Important: Because of danger of injury, do not handle packing without wearing protective clothing and anti-cut gloves!
 	Eye protection and safety helmets must be worn at all times!
	Protective footwear must be worn and should be part of normal workwear every day!
 	Be aware of not standing under floating load!

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Attention: When welding in the column, no inflammable products should be present, and all necessary safety precautions are to be taken.



Structured packing is fire hazardous!

The use of standard cleaning processes are not a guarantee that all traces of hydrocarbons have been completely removed from used packing. There is **always** the potential for residual traces of material to remain upon any packing even after cleaning has been performed. Due to this risk, any work performed above, below or near a packed bed should always be viewed as work performed next to a potential fuel source. Therefore, no hot work, oxy cutting, welding, grinding, or gouging should ever be performed above, below or near a packed bed. For further details we recommend to contact our Tower Field Service Specialist.

All employees will endeavour to keep their workplace clean and tidy to ensure safe working at all times.

Openings in the area where welding is taking place must be closed, as far as practicable if they have any adverse effect on the process being used.

3 Transport and storage

Under normal circumstances, the internals are not assembled before the on-site installation at the customer's premises. The Sulzer structured packings are delivered on pallets or in closed wooden crates. Preferable the storage should be close to column.

The column internals are normally transported banded on open pallets or light crates. Certified to being crane/winch lifted to appropriate installation manways.

The columns are dispatched by rail or road vehicle, unpacked. All openings are closed.

The packing cases are not to be opened until immediately before commencement of installation, preferably in the presence of a specialist from Sulzer. Transport damage to packing case has to be reported immediately to the responsible person.

Inventory checks of boxes / crates to be executed in accordance with Packing Lists. Any shortages to be reported immediately.

The Sulzer structured packings and internals supplied are to be transported and stored in a manner appropriate for the constructional material used:

C-steel / AISI 410S: protect from moisture and dirt

Stainless steel: protect against surface contamination, in particular against the deposition of rust from other sources

Graphite: to be carefully transported, to be stored in a clean and dry environment

Plastics: to be stored in a clean environment, protected from sun light.

The packing cases containing the structured packings will carry suitable instructions concerning transport, e.g. "this way up ↑↑" or "protect from moisture".

The pallets transporting packings and internals cannot be stacked.

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4 Vessel tolerances

The diameters of columns are to be measured and the results compared with the maximum tolerances given below:

Packing type	allowed tolerances in diameter [mm]						
	< 700	701 -1300	1'301 -2100	2'101 -4'100	4'101 -7'000	7'001 -10'000	> 10'000
BX, CY Mellapak ≥ 500	+/- 0.3% of column inside diameter						
Mellapak < 500	+/- 0.5% of column inside diameter						
Horizontal transport	Inside diameter + 5 / 0 [mm], circumference +/-5						

Where the internal diameter is outside (above or below) the mentioned tolerance limits, a check is to be made with Sulzer Chemtech as to whether replacement or adjustment of the packings and internals is required.

4.1 Vertical tolerance V of vessel

For proper operation of packing a maximal allowed verticality is to be kept. The verticality **V** is a function of the column height. The horizontal difference **x** between column head and sump is verified.

$$V = \frac{x[\text{mm}]}{\text{column_height}[\text{mm}]} \cdot 100[\%]$$

Column type	column head to sump	per section
flanged columns	0.3 %	0.1 %
welded columns	0.3 %	

4.2 Tolerances for weldings

To prevent wall leakage during operation of packing the column welding must be defined as following.

Flanged columns: grind welding ropes complete for:

- ID < 800 mm and BX, CY packings

max. 2 mm welding ropes allowed

- ID > 800 mm and BX or other packings

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5 Setting-up the column

All equipment is to be checked for cleanliness before installation. Sealing surfaces are to be very carefully handled during the assembly work.

The erection sequence for the two principal column designs is as follows:

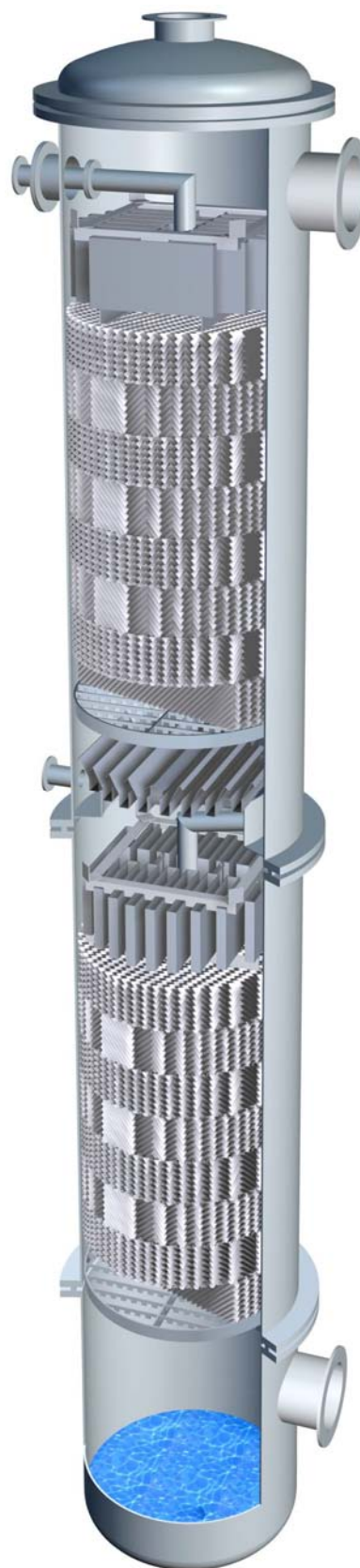
5.1 Flanged columns of sectional design

First the column sump with the skirt or the part of the column carrying the support lugs are placed in position and the connecting flange of the column is aligned to the horizontal, maximum deviation 0,1 %. After assembly of all column sections, the verticality is to be checked by using a plumb line or a theodolite. The assembly of the vertical sections of the column takes place section by section. Instructions for this are given in the column assembly drawing.

Already assembled sections have to be transported in the vertical position and with minimum mechanical stressing.

Slim columns have one or more guide supports. Ensure that the column can expand along its axis.

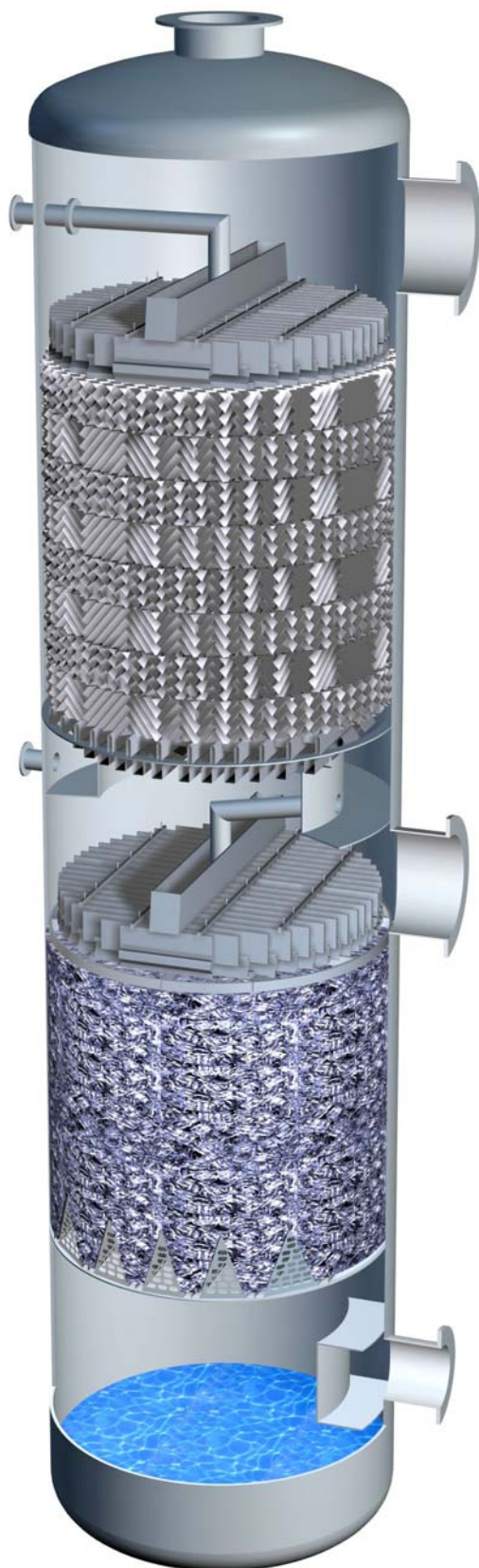
Packings and internals are installed through the column flange.



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5.2 Welded vessel columns, monoblock type

The column is set upright by means of suitable lifting equipment and lowered onto the prepared foundation, and the required verticality checked.

All segmental internals are installed through the manholes.

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6 Column revamps

Responsibility of client: column gas free, cleaned and isolated, accessibility, safety and waste disposal.

Existing nozzles and manholes which will be reused to be checked for correct elevation and orientation.

After removal of existing trays and rings, the column diameter as out of column roundness must be checked. If necessary recommendation for corrective action to be taken.

The final phase of the removal of the old internals and the installation of the Sulzer components are to be supervised by Sulzer personnel.

6.1 Preparation

A well carried out preparation shortens the installation time. The following items have to be attended to:

- general procedures made known
- clearance for entering column (gas free)
- ventilation (fans or breathing apparatus)
- lighting within the column (low voltage)
- accessibility, scaffolding, cranes, hoists, rope-ladder, rope set, etc.
- means of transport and routes to be followed
- partial pre-assembly (in order to save time during shut down)
- telephone or radio communication
- safety regulations
- correct storage of hardware

6.2 Dismantling of existing trays

The rational removal of the trays is dependent on the following:

- type of tray
- type of fastening (clips, screws, welded construction etc.)
- year of construction, material
- corrosion and product residue
- check for presence of Asbestos tape

Note: Some trays might be used as platforms

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7 Cutting off the rings

Attention: When welding in the column, no inflammable products should be present, and all necessary safety precautions are to be taken.



Structured packing is fire hazardous!

The use of standard cleaning processes are not a guarantee that all traces of hydrocarbons have been completely removed from used packing. There is **always** the potential for residual traces of material to remain upon any packing even after cleaning has been performed. Due to this risk, any work performed above, below or near a packed bed should always be viewed as work performed next to a potential fuel source. Therefore, no hot work, oxy cutting, welding, grinding, or gouging should ever be performed above, below or near a packed bed. For further details we recommend to contact our Tower Field Service Specialist.

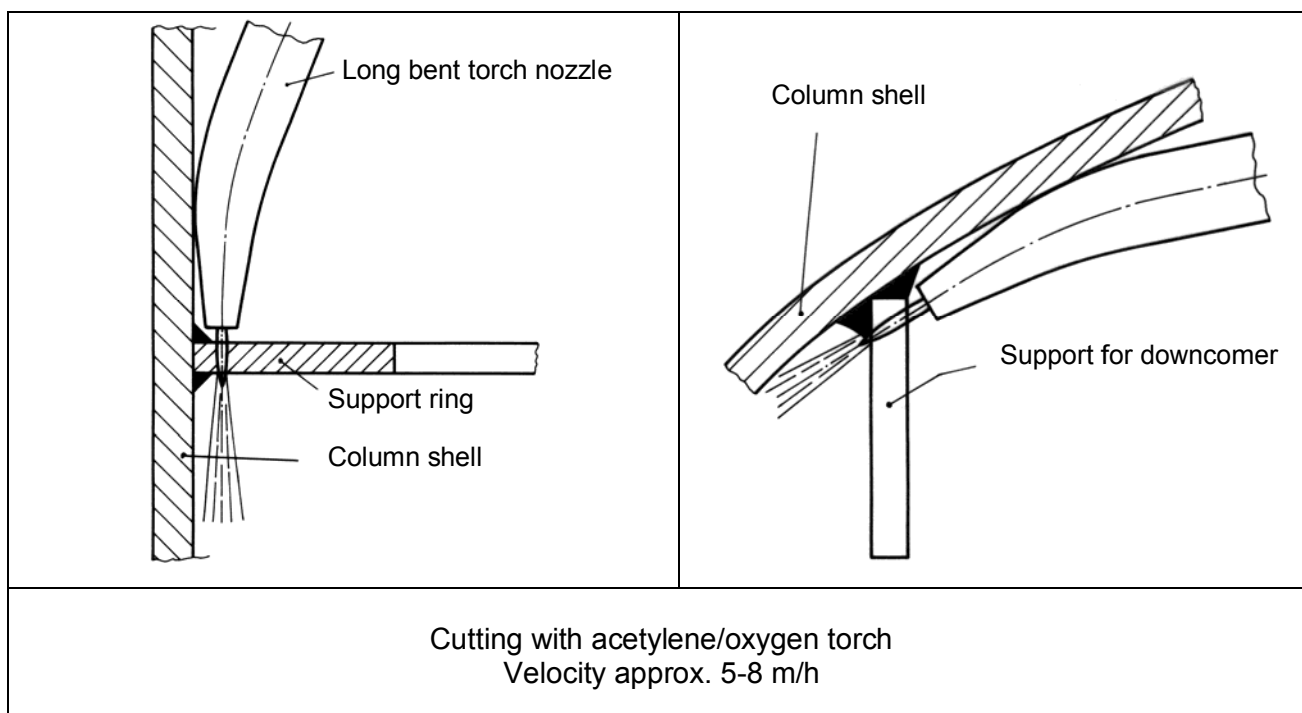
All rings, brackets, inward projecting pipe connections have to be removed from the area into which the structured packings are to be installed. Any unavoidable projections still remaining after removal of the rings etc. are not to exceed:

- 5 – 10 mm for welded carbon and stainless steel columns

Tray rings are to be removed by flame cutting.

Wherever possible, existing rings are to be utilised and, if necessary, supplemented to carry new ring channels and support beams.

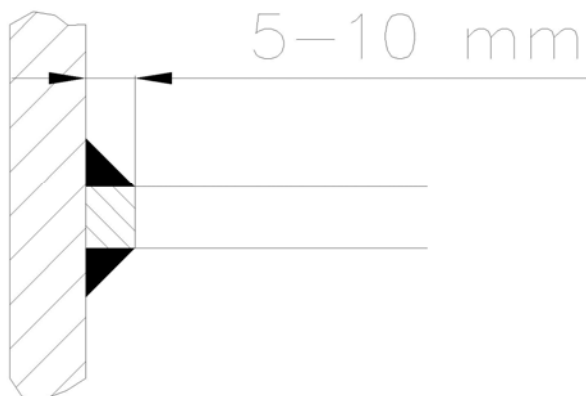
7.1 Cutting of tray support rings in carbon steel



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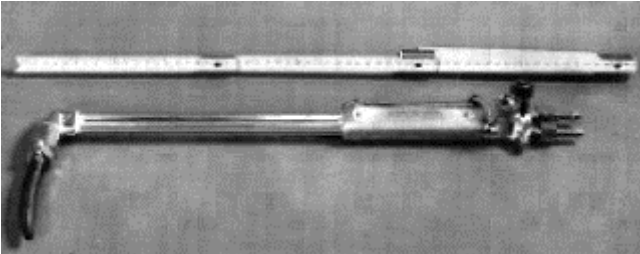
Rest of ring after flame cutting < 5 – 10 mm

Cut has to be cleaned with brush. Normally slight grinding is required before wire brushing.

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Torch for Oxy-Acetylene/O ₂ mixture with jetvalve to purge Oxygen		Nozzle of torch, especially long and bent	

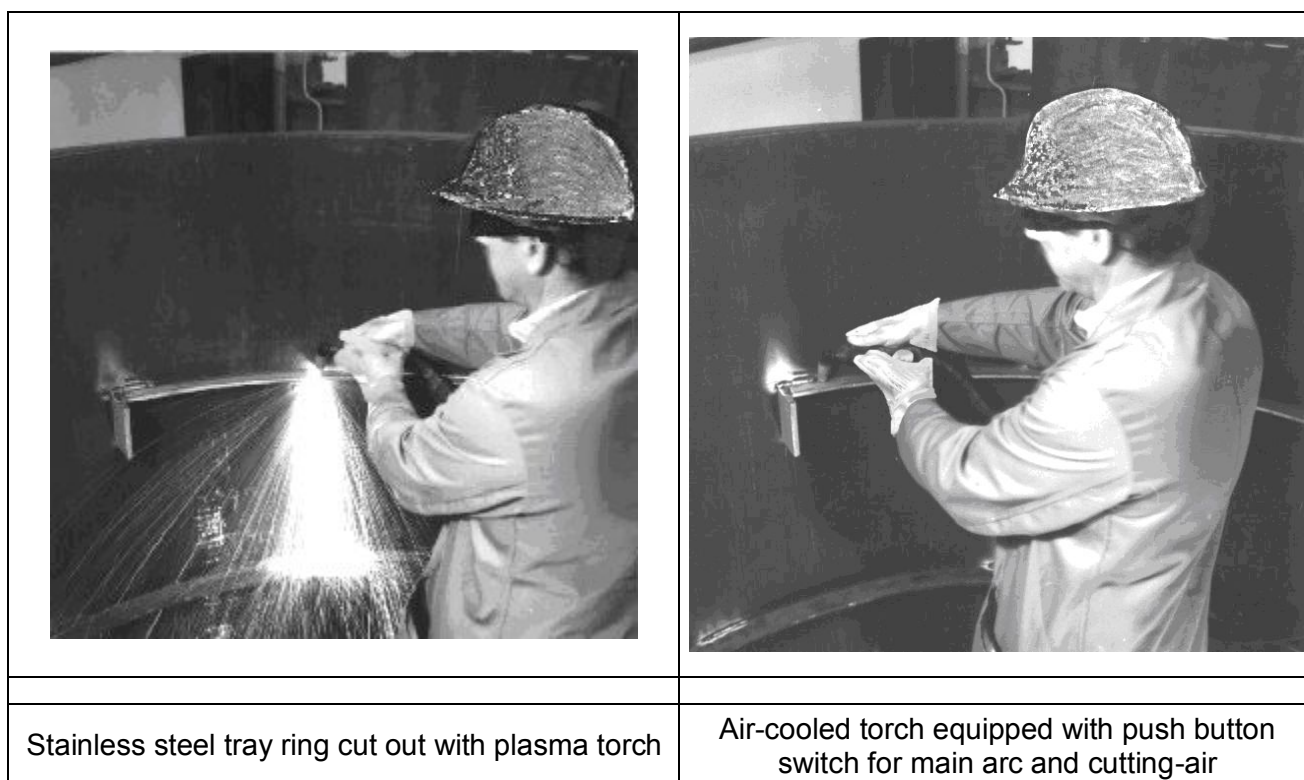
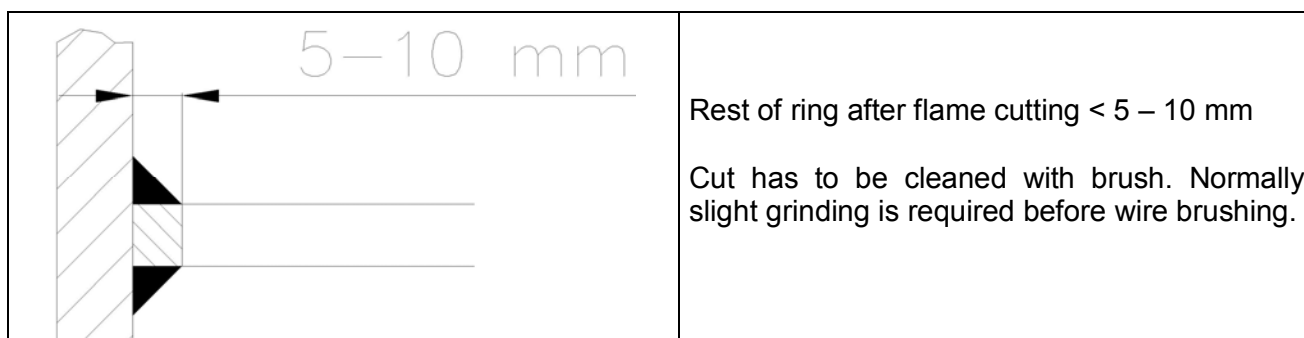
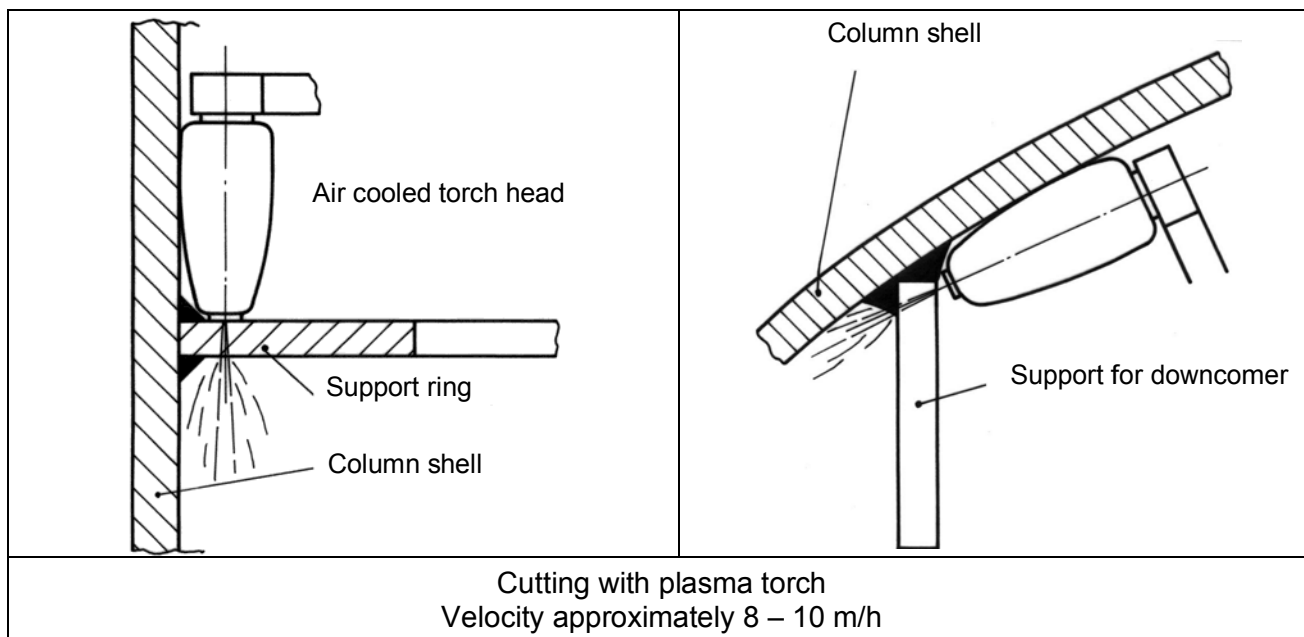
			
Cutting of carbon steel tray ring with Acetylene/Oxygen torch		Cut-remnant 5 to 10 mm, shown before cleaning with wire brush	

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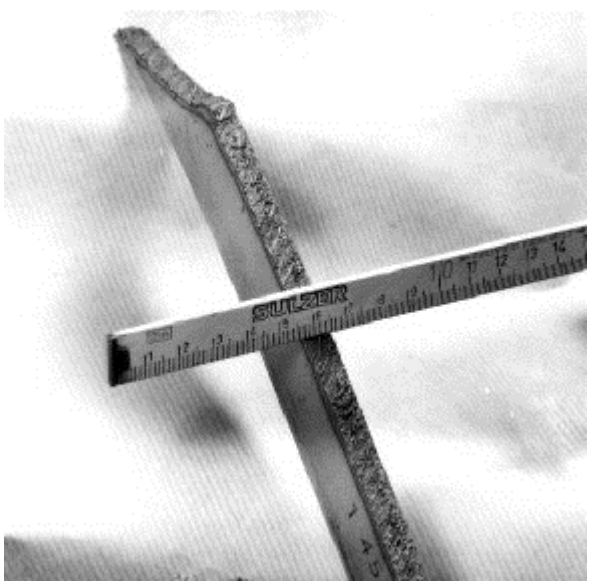
7.2 Cutting of tray support rings in stainless steel



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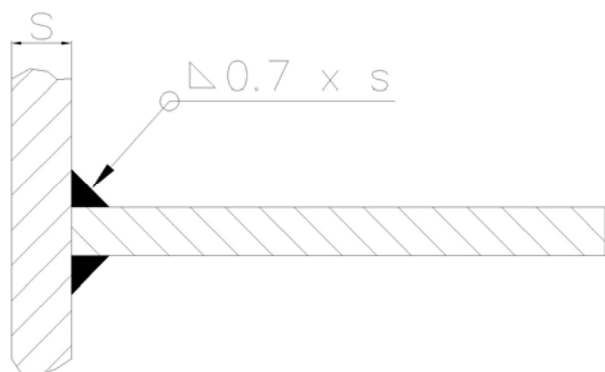
			
Surface of cut out ring segment, material space thickness 1 to 12.5 mm		Ring 5 to 10 mm deep, clean cut with wire brush	

7.3 Welding

All welding to be performed by qualified welders according to the applicable pressure vessel code.

Welding procedure specifications (WPS) and Procedure Qualification Records (PQR) for the involved materials must be available.

Site welds are clearly marked with the sign on the drawings submitted.

Parts welded to the column wall must be welded on both sides with thoroughly filled welds. If not specified on drawings, all weldments to be as follows.	
---	--

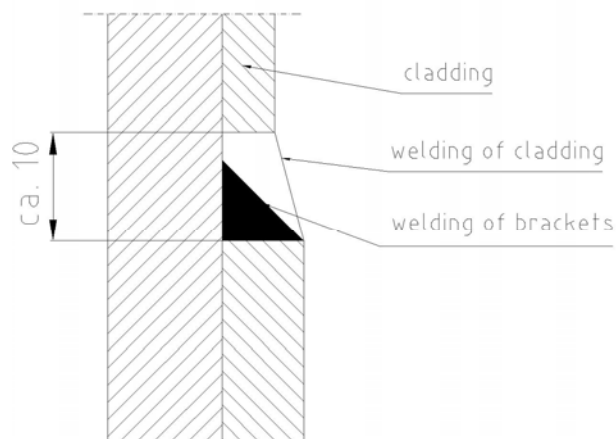
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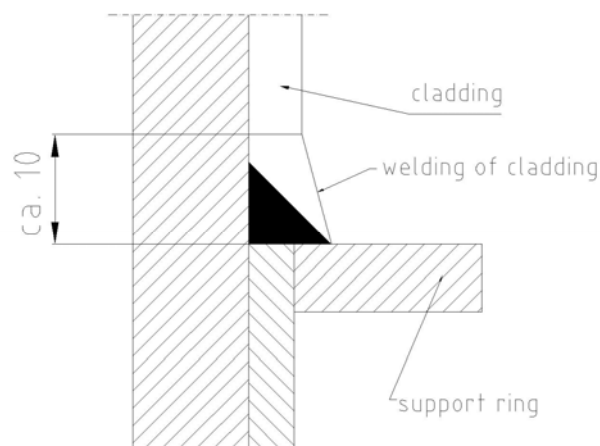
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For load carrying brackets (beam brackets), the bracket welding to the vessel wall should be executed as follows:

Note: Venting holes in reinforcement plate to be closed in hot condition.



Supports and support rings are welded as follows:



Before any welding application on to the vessel wall the base or ground clean surfaces must be checked visually for cleanliness and by PT (liquid penetration method) for any material flaw. After welding the weldments i.e. the vessel surfaces must be checked again.

Cracks or any indication of flaws shall be submitted for consideration or decision by the client resp. any other statutory organisation determined by the refinery or contractor.

Nozzles and manholes are welded and tested according to the refinery procedures and specification.

Chimney trays, downcomers and ring channels to be seal welded. Following instructions are important:

- seal weld sizes must be kept to the minimum necessary to effect liquid tight joints
- the heat build up must be kept to a minimum to reduce plate distortion.
- welding must start from the centre progressing forward the side.
- the last weld must be the welding on to the support ring or vessel wall.

7.4 Welding on lattice beams

This welding must be done in stitch fashion. No great heat build up is allowed in order to avoid distortion.

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7.5 Tolerances for brackets

Maximal accepted deviation for brackets and support rings according **Fig.5**

Vertical bars to liquid collector must be parallel to centre line. Maximal accepted deviation see **Fig.6**.

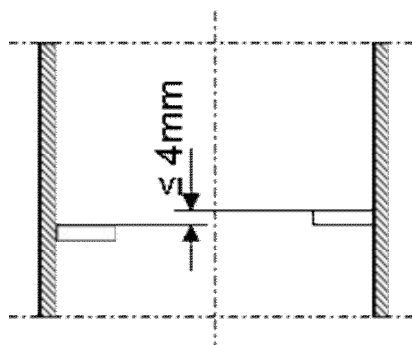


Fig. 5

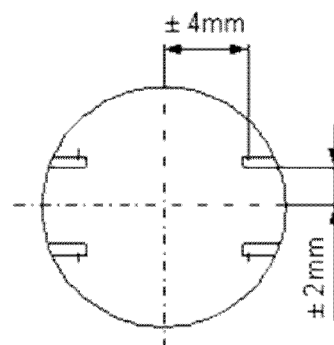


Fig. 6

7.6 Typical installation tools necessary for revamping columns

Proposed tools:

- Block chain (500 kg) [1100 lbs]
- Motor cable winch
- Mobil crane
- Magazine container
- Acetylene/oxygen torch, 3 x 50 m [160 ft] hose
- Arc welding machines incl. 5 x 40 m [130 ft] cable
- Electric grinding machine (slider) angular-type diameter $\varnothing$ 150 mm [6"]
- Electric grinding machine, diameter $\varnothing$ 115 mm [4.5"]
- 220 V Isolating transformer
- Halogen lamp 500 W
- Cables lightening
- Sledge hammer (fore hammer) and hammers
- Aluminium directing bar (lath) 3 m [10 ft] long, new and accurate
- Tape measure (surveyor's tape) 10 m [32 ft]
- Spiral level bars
- Plasma cutting machine
- Ventilation units
- Fitter tool boxes
- Levelling instrument (Laser)

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8 Filtration of the Feeds outside the Columns

The filtration of the liquid feed to ensure that no solids are entering the column is the responsibility of the customer. Cleanliness is an important factor for good functioning of the column because of the risk to plug the distributor holes.	Recommended external filtration for Feed and Reflux max. Mesh size: [mm] 
--	--

Basically, two sources of contamination have to be prevented:

- Contamination caused by new equipment, pipes and by installation
- Contamination caused by the feeds, reflux, vapour inlet, and other inlets

If contamination arises from a), filters are to be fitted for the first start-up phase.

If contamination as per b) should arise, continuous filtration is required.

Two filters are always to be fitted together with a switch-over facility. The mesh aperture size is to be chosen to match the diameter of the hole of the liquid distributor. Filter size is dependent on the flow rate, the degree of contamination and on the pumping capacity.

Should as well fine or coarse particles be deposited in the distributor arm channels, as liquid flow velocity is very low, it could be only then a question of time before the distributors are blocked. In this situation you must as well implement a filtering device, inside or outside the column.

9 Degreasing of internals

Where oil residues on packings, internals and column parts are to be removed before the column is commissioned and where the product itself is too valuable or unsuitable for use as a cleaning agent, the degreasing of internals takes place after assembly of said items into the column. A suitable solvent such as Acetone or Perchlor is added into the column. Care should be taken that all inlet and outlet pipelines are flushed out and that the connected equipment and reservoirs are likewise clean. Afterwards, the column is to be operated for about 8 hrs under total reflux conditions and with sufficient gas loading. This means that column, packing and internals are washed down with clean solvent and that fats and oils collect in the sump or in the evaporator. (If the solvent was merely circulated, the contaminants would only be diluted!)

If aqueous mixtures are to be distilled in operation, or if packings and internals have to be free from grease for other reasons, it is worthwhile to order degreased packings and internals from Sulzer. In such a case, however, it has to be established that the column, pipelines, connected equipment and tanks are absolutely clean and free from grease before fitting and that the assembly itself is carried out with the highest degree of cleanliness. If necessary, a final cleaning as described above has to be carried out.

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10 Final Inspection of Installation

On completion of the plant installation, before the column entry manways will be closed, inspection has to be carried out.

The correct installation of packing and internals is essential for a good column performance and hence recommend that a Sulzer supervisor is used to supervise the installation. Our erection supervisor will write an erection supervision protocol relating to the scope of work applicable to the Sulzer packing and internals.

11 Experience and frequent errors

A few items are listed below which have a negative influence on the proper functioning of Sulzer columns:

- inlet pipes without filters, with filters dismantled or bypass open
- pipes installed without downwards gradient or with liquid catchments
- suction head of circulating pump too small
- irregular reflux from condenser which flows back uncontrollably into the column
- unsuitable measuring and control instruments, e.g. for the pressure drop
- operating conditions not constant
- poor thermal insulation
- sub cooling of the reflux which is not taken into account for the thermal balance
- blocked distributor
- distributor too little loaded (liquid well below minimum load)

12 Installation Services Sulzer Tower field service

To get column internals installed the SULZER Tower field service group can be asked for support and organisation of the whole revamp or supervision. Sulzer Tower Field Service personnel have extensive knowledge of all types of vessel and tower internals to support for all internals equipment installation requirements.

Contact:

- tfs.australia@sulzer.com
- tfs.brazil@sulzer.com
- tfs.canada@sulzer.com
- tfs.china@sulzer.com
- tfs.germany@sulzer.com
- tfs.india@sulzer.com
- tfs.mexico@sulzer.com
- tfs.middle-east@sulzer.com
- tfs.asiapacific@sulzer.com
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- tfs.europe@sulzer.com
- tfs.usa@sulzer.com

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13 Supervision report

Client (Name, Address):

Project name: **Project.-No:**

Column No:

Responsible coordinator: **Installation company:**

Supervisor:

	Executed work inspections	YES	NO	N.A.	REMARKS
1	Vertical deviation of column < 3 %.				
2	SULZER Packing installed according to installation instructions				
3	Internals are installed according to installation instructions				
4	Liquid distributor levelled				
5	Inlet pipe correctly introduced into main channel (pipe distance as per drawing)				
6	Vane collector correctly installed (overlapping ring channel)				
7	Vane collector for flanged columns correctly sealed				
8	Leak test of Chimney tray performed				
9	Opening for temperature sensor in packing performed				
10	Demister correctly installed				
11	Visual cleanliness of column satisfactory				
12	All manholes closed				

13 Packing type

H1 [mm or in] = Distance between top layer of packing and ☐ lower edge of manhole
☐ flange

	Bed 1	Bed 2	Bed 3	Bed 4	Bed 5	Bed 6
Packing type						
H1 [mm / in]						

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CLIENT

Name:

Name:

Signature:

Signature:

Location / Date:

Location / Date:

Section 6

Installation Instructions for Internals

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1 Preface

These instructions are intended as a guideline for the installation of all types of internals manufactured by Sulzer Chemtech.

Good column performance can only be achieved if the following instructions are adhered to, and the installation is correctly carried out.

To be able to install the internals, and within the shortest time, a thorough planning of the installation procedures and instructing of the installation personnel are of paramount importance.

The installation should be supervised by a Sulzer supervisor. Sulzer does not take over costs caused by unqualified installation. The performance guarantee is only valid if the installation is carried out under Sulzer supervision. See also THbl-01 for General Safety instructions.

2 General Preparation Information

Prior to install any internal, the following must be observed and verified according to the assembly or welding attachment drawing.

- Clips, rings etc. for fixing the internals correctly positioned
- No debris will be allowed such as welding splatter, grinding, corrosion particles, or any foreign matter as this might cause plugging or fouling tendencies.

Internals for flanged columns are supplied in one unit; whereas for monobloc columns the internals are supplied in sections in order to fit through the manhole.

2.1 What should be avoided?

- Any welding or grinding after the installation of packing or distributor
- If welding or grinding is required, special care should be taken to cover the packing and distributor to prevent from fire and plugging.
- The cover should be of fireproof material. After any work, the packing and distributors must be cleaned again.

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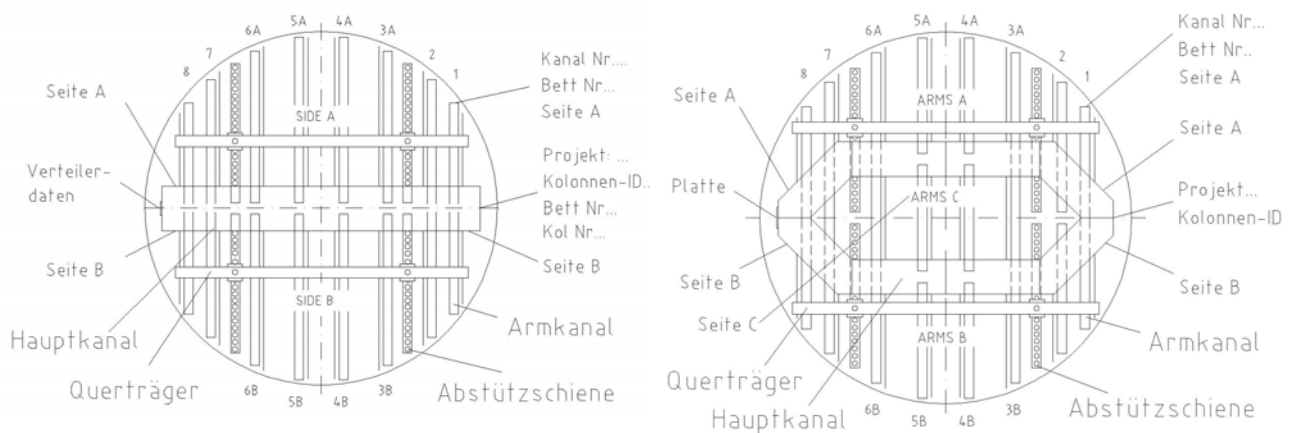
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3 Orientation of Liquid Distributors

The liquid distributor is the most important unit of tower internals. The target is to equally distribute the liquid over the cross-section.

The individual distributor sections are well marked to enable easy assembling inside the column.



General Installation Instructions for Levelling

Distributor on top of packing oriented 45° to top layer of packing	Support grid at bottom of packing oriented 90° to bottom layer of packing

Further, the distributors must be positioned precisely aligned in the centre of column and horizontally installed with levelling devices. These devices are either locating grids, levelling bars, jigs or suspension screw arrangements.

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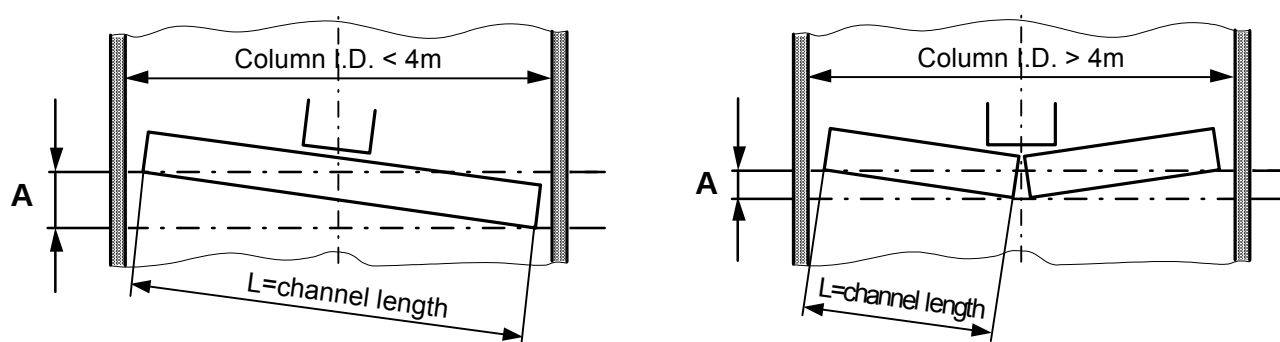
The levelness must be checked with accurate spirit level gauges. For columns >3m, we recommend laser instruments.

4 Acceptable levelness criterion

If not otherwise stated, the maximum permissible deviation A:

$A \leq 1 \text{ ‰}$ of channel length $L < 2\text{m}$

$A \leq 2 \text{ ‰}$ of channel length $L > 2\text{m}$



The levelness must be checked and verified in both axes, **x** and **y** during and after the installation. Measuring points are at the ends of each arm or main channel, (see Fig. 3).

5 Fixation

After final levelling the liquid feed gravity distributors must be secured tightly in the levelled position.

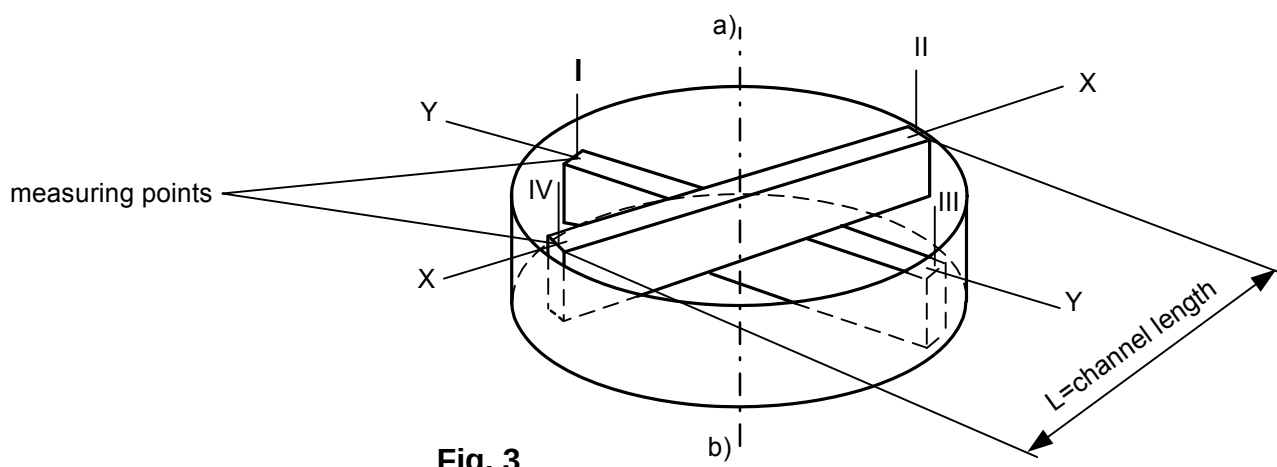


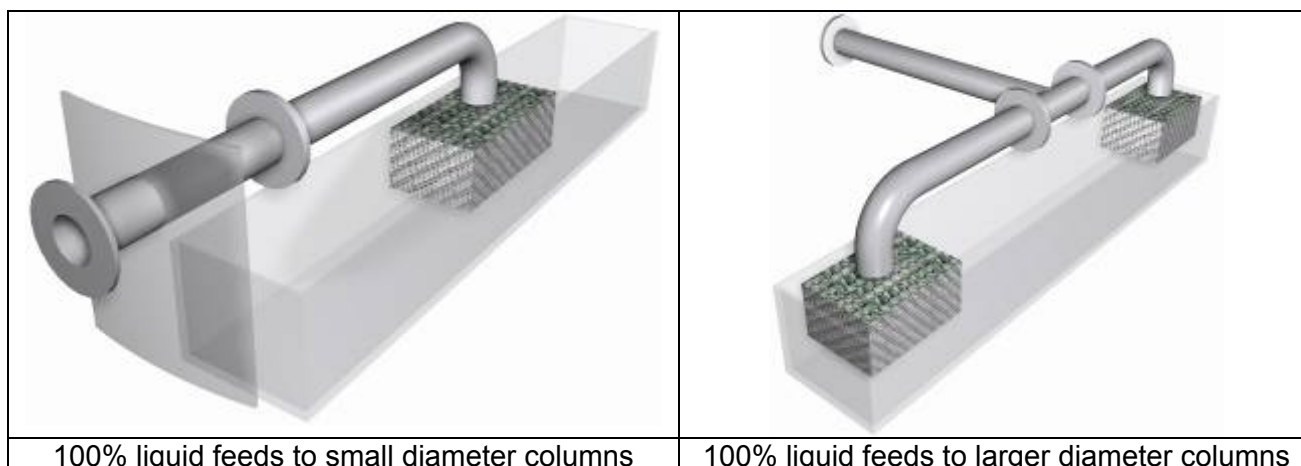
Fig. 3

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6 Liquid inlet systems (LV)



These types of feed systems meters flow to one or more appropriate feed areas, matching the hydraulic requirements of the distributor. Each feed area may require a device to calm the liquid flow from the feed pipe.

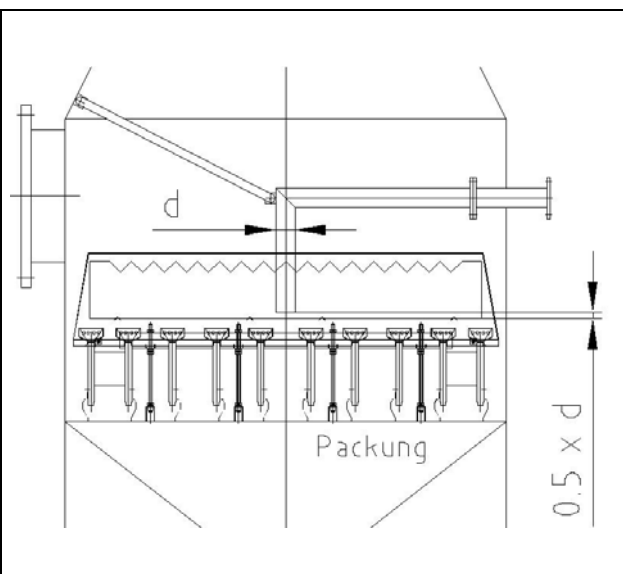
Standard arrangement

With the standard design, feed pipes attach to the internal column flange. For larger columns the pipe additionally may be suspended to tower wall clips.

The distance between feed pipe outlet and main channel or pre-distributor channel has to be according to the assembly drawing and must be adjusted during assembly. If not specified on the drawing the distance has to be:

$$0.5 \times d$$

d = Inlet pipe diameter

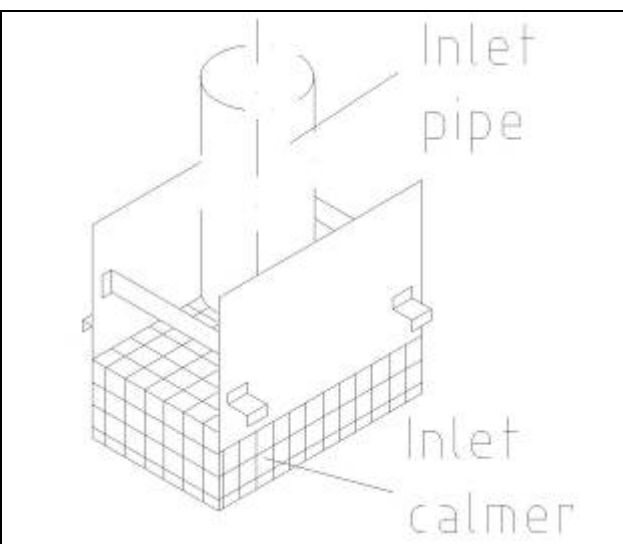


Using of inlet calmer

The feed area may require an inlet calmer. The inlet device is suspended in the distributor at the position of the inlet pipe. The liquid is redirected and calmed with random packing elements into the distributor.

The distance between feed pipe outlet and inlet calmer has to be according to the assembly drawing and must be adjusted during assembly.

If not specified on drawing the distance has to be between **0 and 10 mm**.



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7 Liquid distributors

7.1 (VE- distributors)

Depending of the discharge system, the distributor types are distinguishable between VEP and VEG.

7.1.1 Splash-plate distributor VEP

The VEP is an all-round distributor for a lot of applications. The big lateral holes are insensitive to dirty liquids and the optimized splash plate allows very high gas loads.

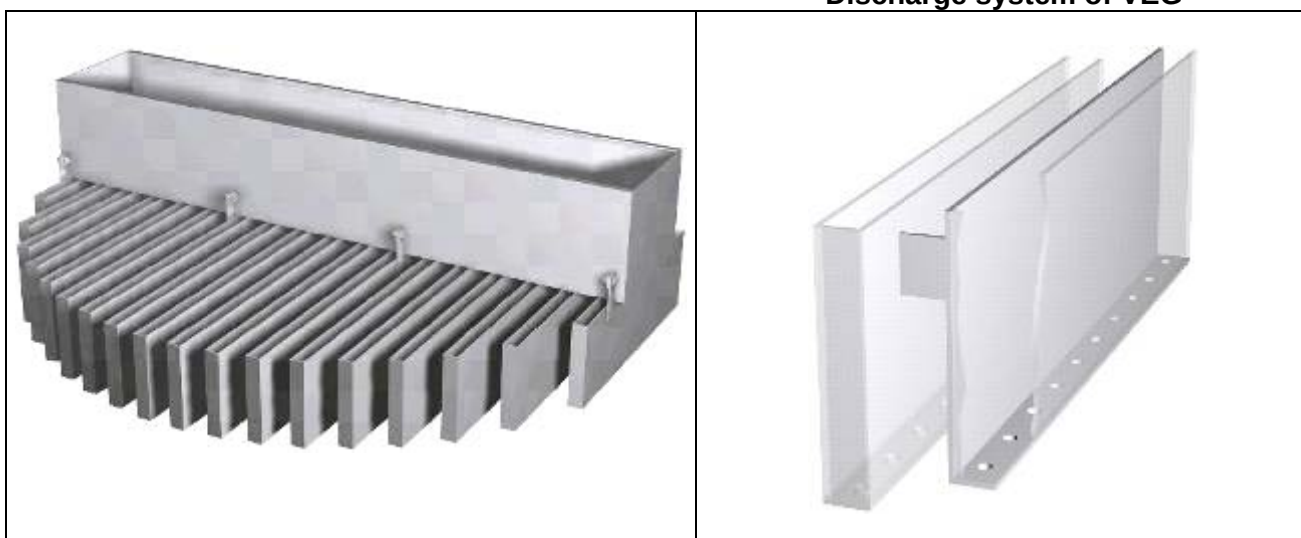
Discharge system of VEP



7.1.2 Bottom-hole distributor VEG

The distributor VEG resembles the widely used splash-plate distributor VEP. The difference is that the liquid is discharged through holes in the channel bottoms rather than laterally against a vertical baffle. It is not recommended for liquids containing solids.

Discharge system of VEG



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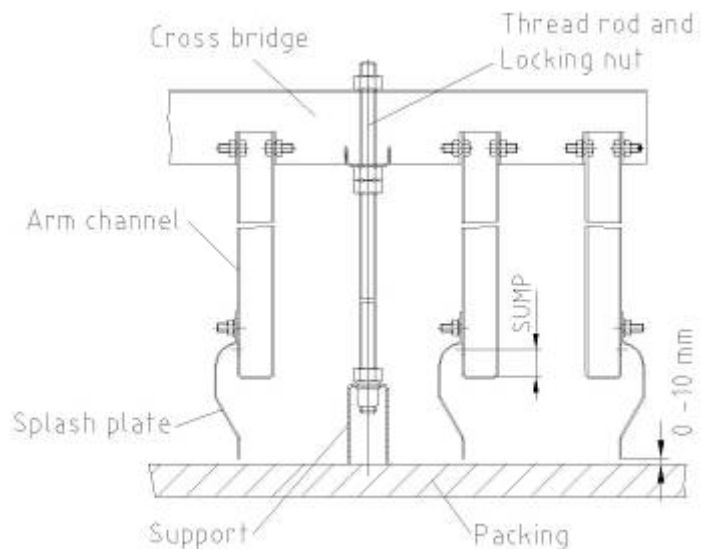
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7.1.3 Design concept of VE-Distributors

Side view of VEP distributor

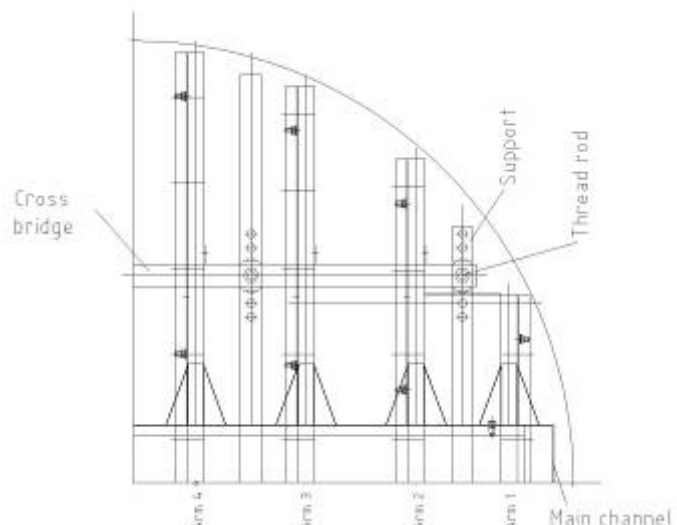
- The arm channels are bolted to the cross bridges and the supports act as locating grids.
- The cross bridges are pillared and for example supported by threaded rods which allows for jiggling and levelling of the suspended arm channels.
- At the correct level the jigs screw arrangement must be tight.
- For VEP distributors the clearance between splash plate and packing is about 0 to 10 mm.
- For VEG distributors the clearance between distributor and packing has to be according to drawing.
- The distributors are placed directly on the packing supported by the jigs.



7.1.4 Installation procedure for VE-Distributors

Top view of VEP distributor

1. First pre-assemble the thread rods to the supports and place them on top of packing according to drawing.
2. Place the arm channels between the supports according to drawing.
3. Then install the cross bridge in aligned and perpendicular position to the thread rods.
4. Align and fix all arm channels to the cross bridge and start levelling the arm channels. After levelling and tightening, install the main channel.

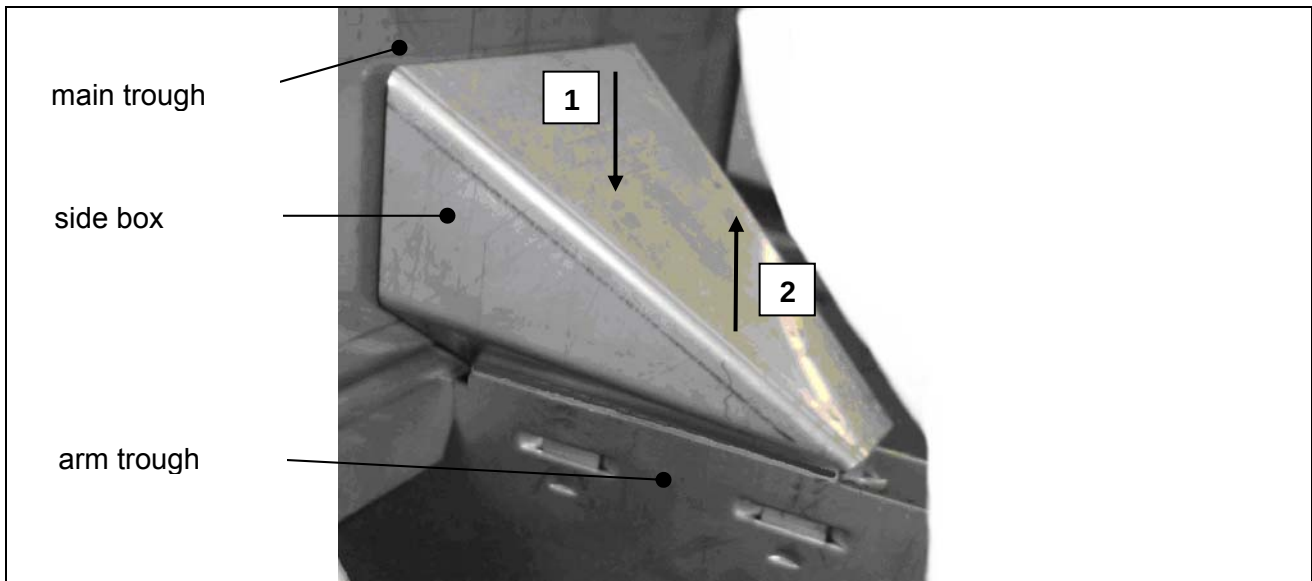


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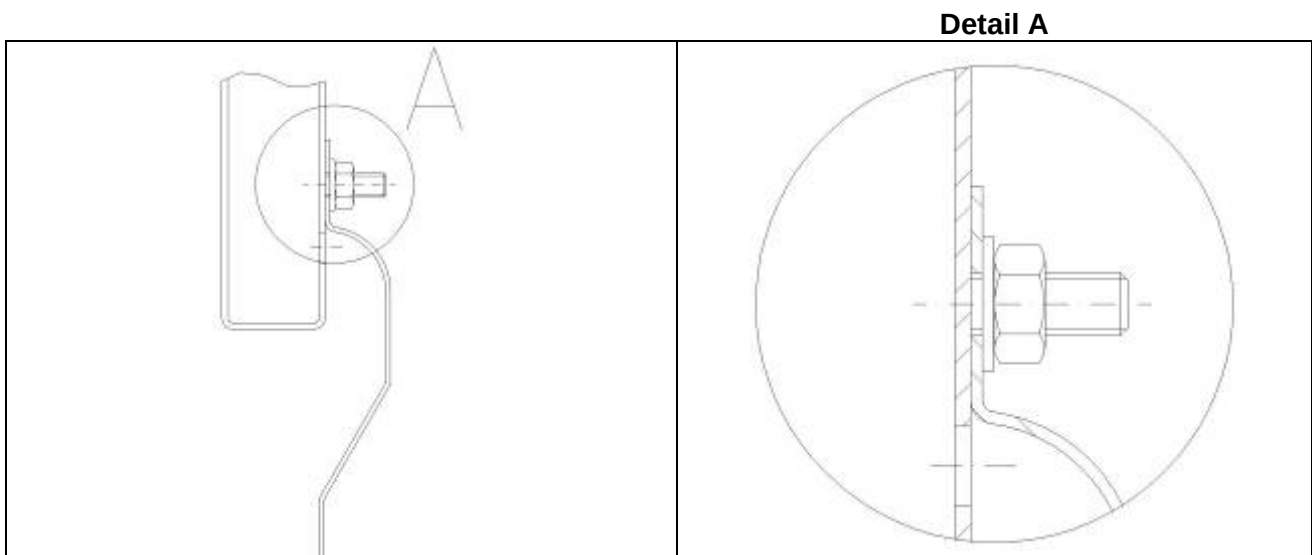
7.1.5 Fixation of side boxes (VEP distributors)



1. Insert it into the arm troughs from top and make sure that the side box will be fixed on place.
2. Check sitting by pulling from below

It must not be possible to remove the side boxes without pressing the arm trough.

7.1.6 Fixation of VEP – splash plate



For the VEP the correct fixation of the splash plates has to be verified before installation.

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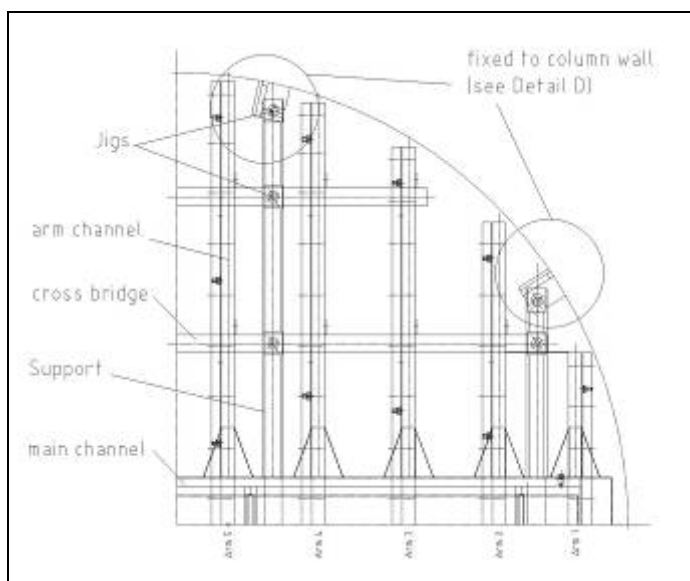
7.1.7 Self supported VE Distributor design

For columns with diameters bigger than 1m, it is also possible to self-support distributors from column wall.

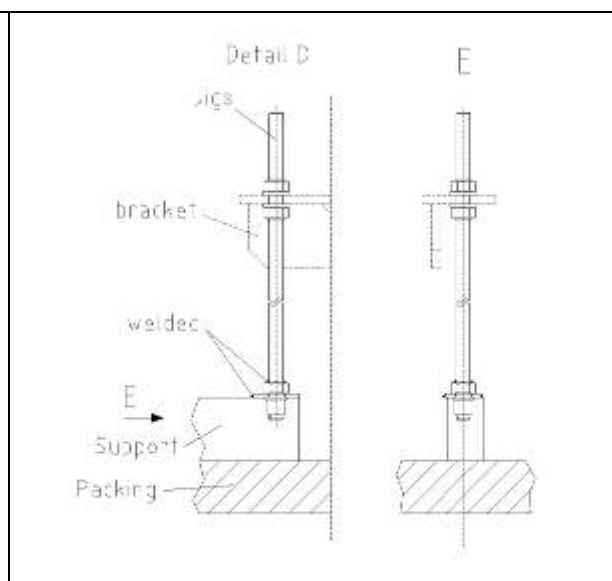
The advantage of this system is that the distributor will remain in position if packing corroded.

The installation procedure is the same as for distributors standing on the packing but additionally the supports (feet's) will be fixed to the column wall according following details.

Top view of VEP distributor



Self supported VE Distributor design



The level has to be verified and the bolt devices have to be tightened.

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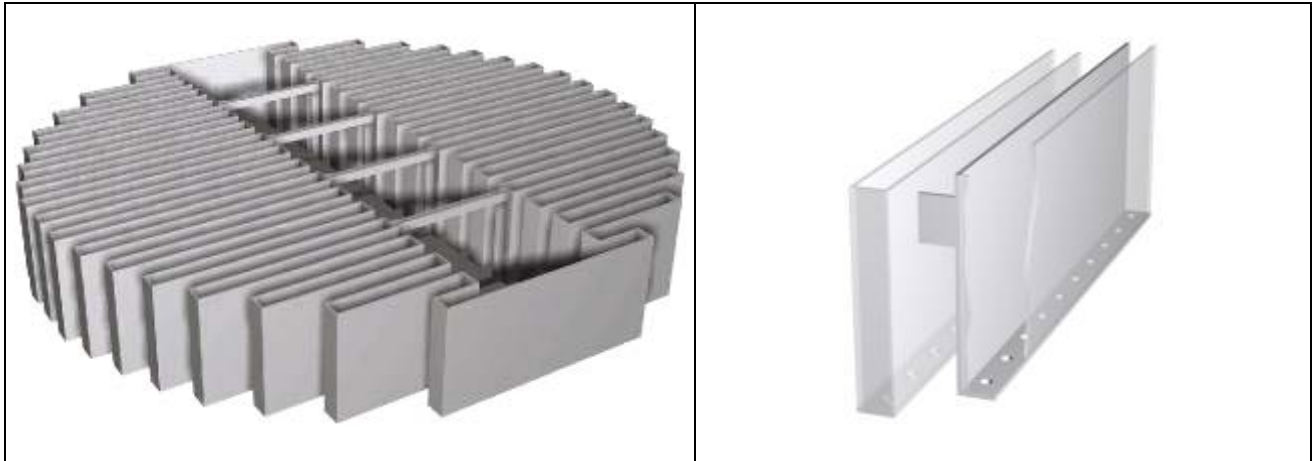
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7.2 VK-distributors

Depending of the discharge system, the distributor types are distinguishable between VKG or VKR.

7.2.1 Channel-type distributor with bottom holes VKG

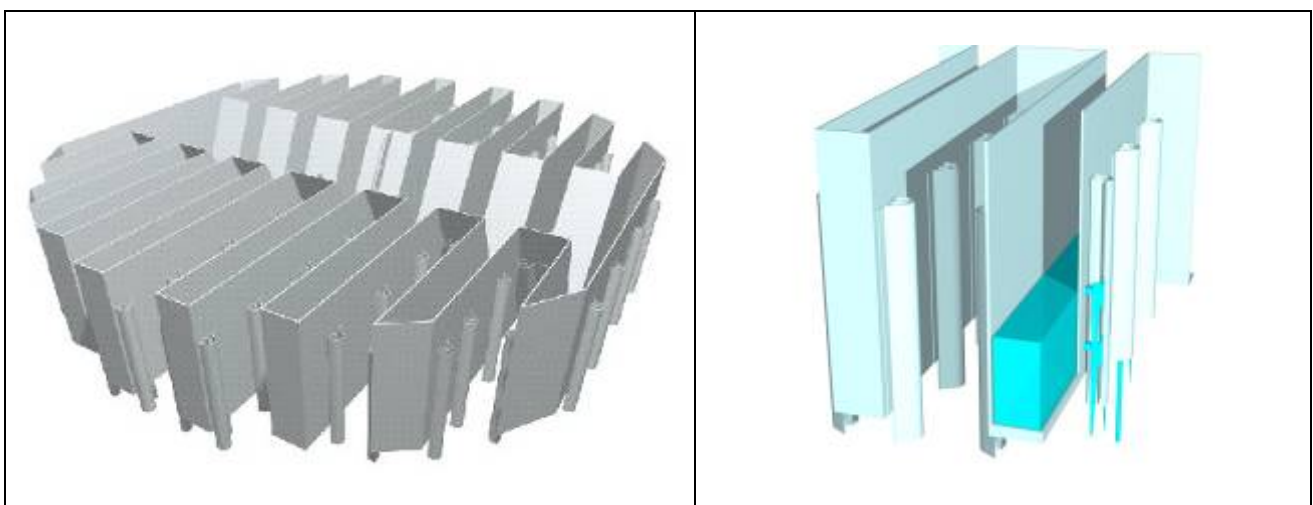
Discharge system of VKG Distributors



7.2.2 Channel-type distributor VKR2

The distributor VKR2 is distributing the liquid through pipes, which are connected on both side of the arm troughs. The Liquid is guided in a high capacity drip pipe to the top of the packing.

Discharge system of VKR2 Distributors



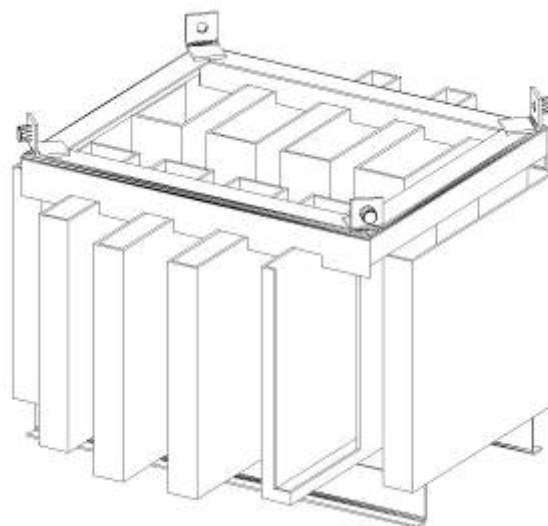
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7.2.3 Design concept for one piece VK Distributors

For small columns the distributors are in one piece. The arm channels are welded to the main channel.

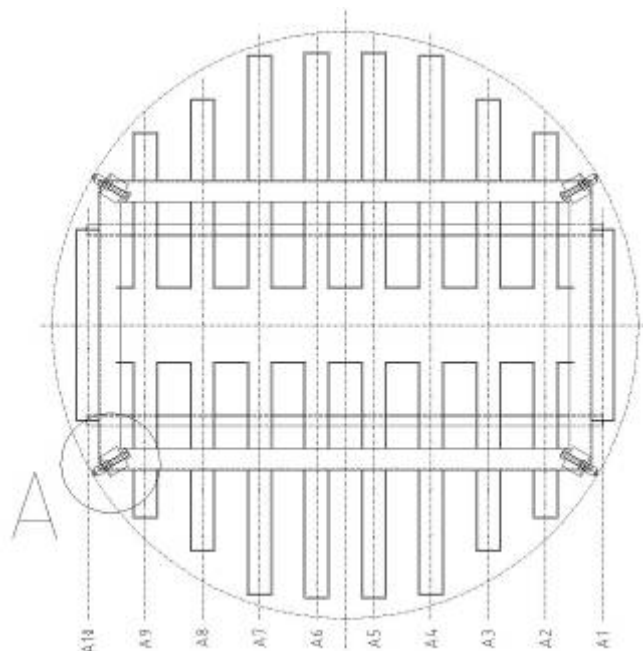
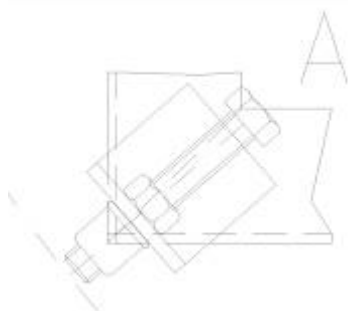


7.2.4 Installation procedure for one piece VK Distributors

In flanged column place the VK distributor on the top layer of packing.

Use bolts only to align the distributor in centre of column! (see Detail A)

Detail A



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7.2.5 Design concept for flanged VK Distributors

For columns with manholes, the distributors are in sections to fit through the manhole. The arm or main channels are flanged and bolted together without gasket.

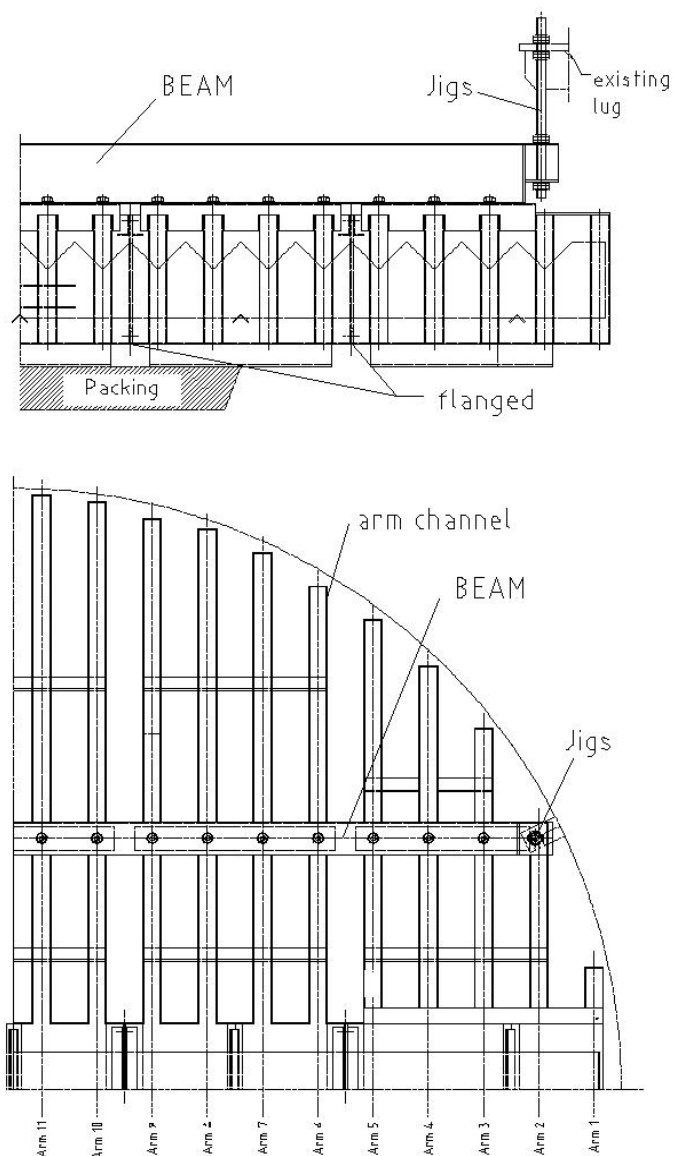
7.2.6 Installation procedure for flanged VK Distributors

Suspended Channel Distributors

The figure on the right side shows a flanged, suspended VKGF.

The installation procedure is as follow:

1. Install all pre-assembled arm channels through the manhole into the column. Start with the smallest, pre-assembled set of arm channels and so forth.
2. Bolt together the flanged distributor segments.
3. At the end bolt the beams to the distributor and start with the level adjustment with the help of the bolt devices.
4. The level has to be verified and the bolt devices have to be tightened.



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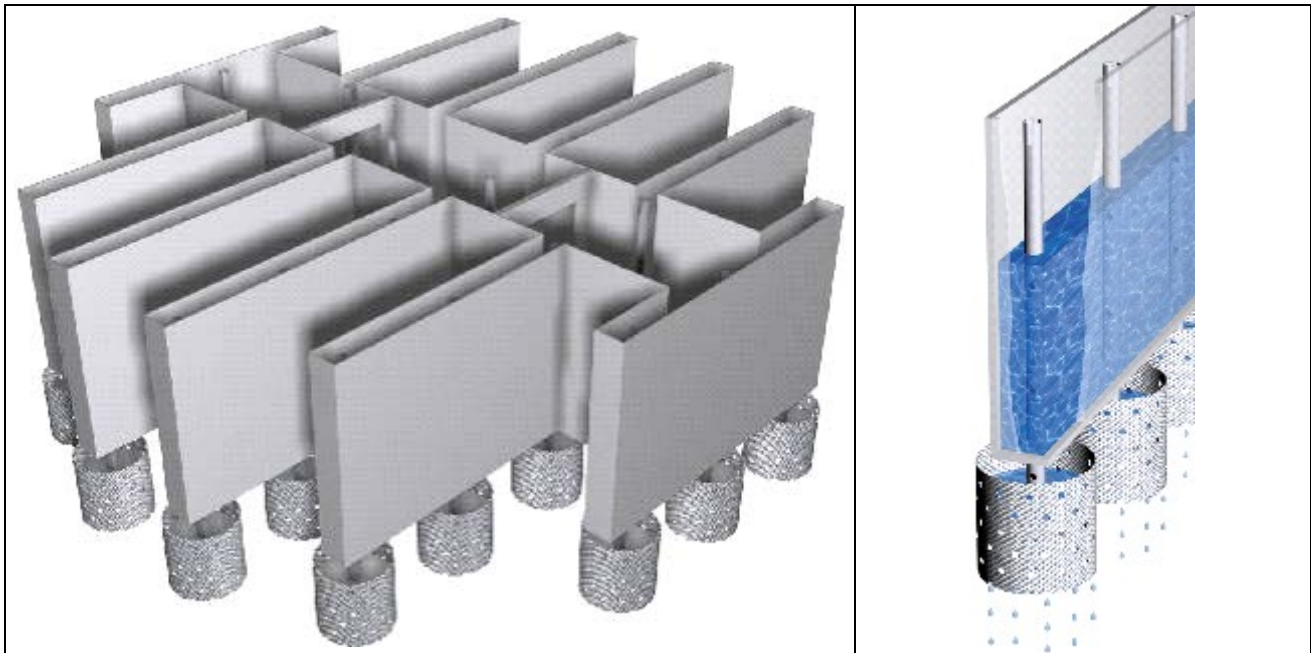
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7.3 Low-liquid load distributor VKRPW

For extremely low-liquid loads, the special channel distributor VKRPW is used to accommodate liquid loads as low as $0.02 \text{ m}^3/\text{m}^2\text{h}$. It has a supplemental liquid distribution system beneath each tube to distribute extremely low liquid volume evenly to the packing.

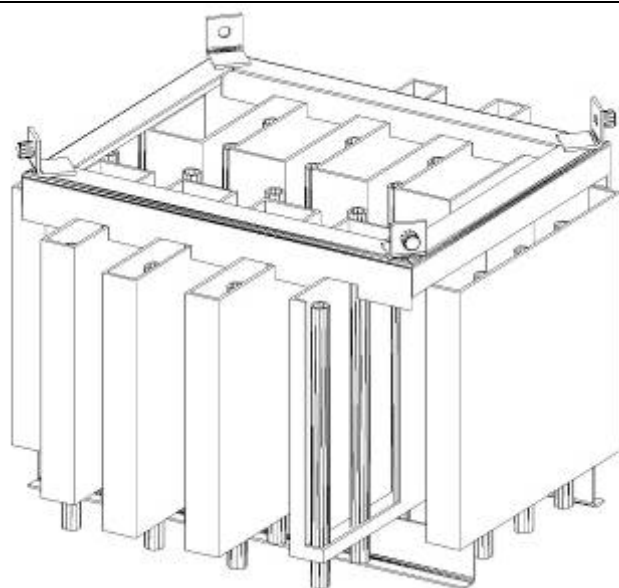
Discharge system of VKRPW



7.3.1 VKRPW distributors for flanged columns

7.3.2 Design concept for one piece distributor

For small columns the distributors are in one piece. The arm channels are welded to the main channel.



(Principle sketch without distribution pot)

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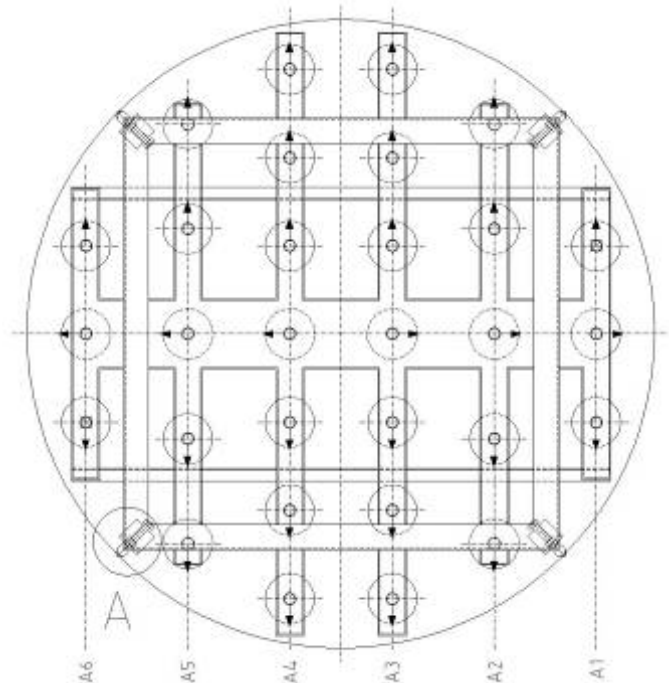
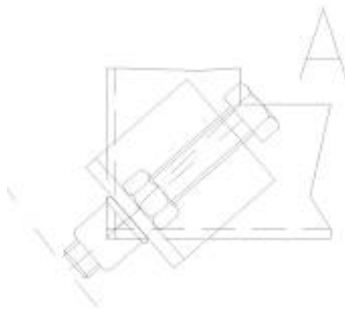
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7.3.3 Installation procedure for one piece VKRPW Distributors

In flanged column place the VKRPW distributor on the top layer of packing.

Use bolts only to align the distributor in centre of column! (see Detail A)

Detail A



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7.3.4 VKRFPW distributors for installation through manhole

Design concept for flanged VKRFPW Distributors

For columns with manholes, the distributors are in sections to fit through the manhole. The arm or main channels are flanged and bolted together without gasket.

7.3.5 Installation procedure for flanged VKRFPW Distributors

First pre-assemble the thread rods to the supports and place them on top of packing according to drawing.

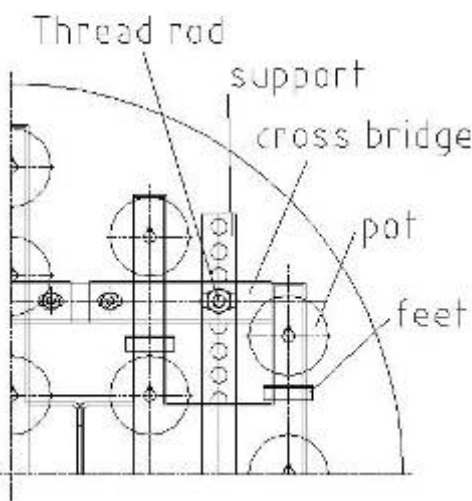
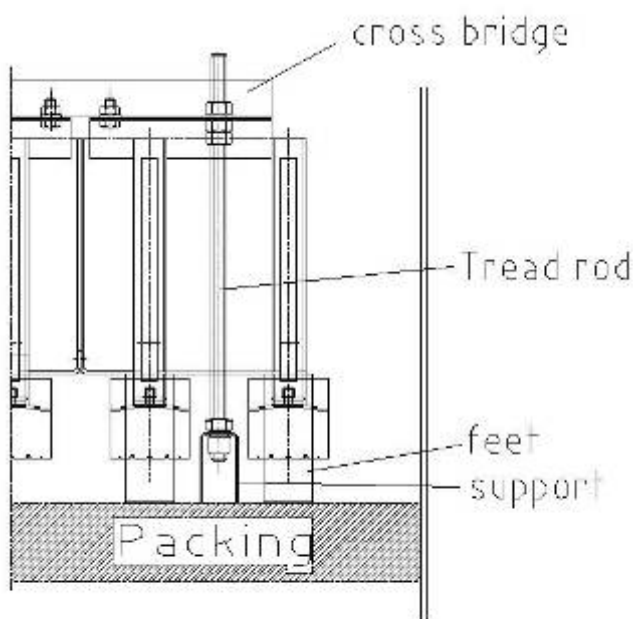
Fix the distributor boxes (pots) to the distributor and place each set of arm channels on top of packing. The feet make sure that the pots will not stand directly on top of the packing.

Bolt together the flanged distributor segments.

Then install the cross bridge in aligned and perpendicular position to the arm channels on top of the thread rods and bolt it to the arm channels.

After levelling and tightening, install the main channel.

Every cup should be in the water level in it self after installation.



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7.4 VRD Spray Nozzle Distributor

It is a flanged pipe design equipped with spray nozzles. This type of distributor employs only liquid feed under pressure.

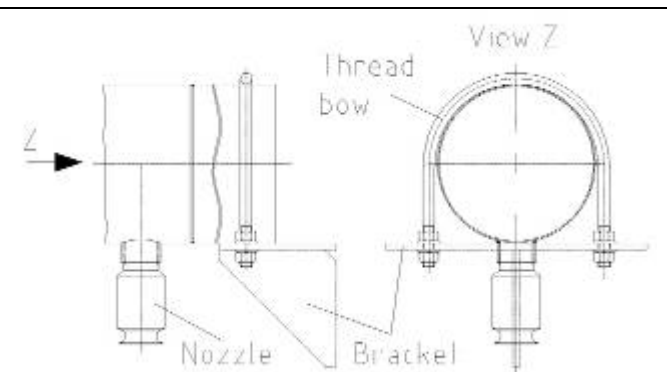
If tangential full cone nozzles are used, coupling must be installed between nozzle and sockets. Column ID > 5m might be equipped with beams on which header and arm pipe are suspended.



Installation through manhole.

7.4.1 Location

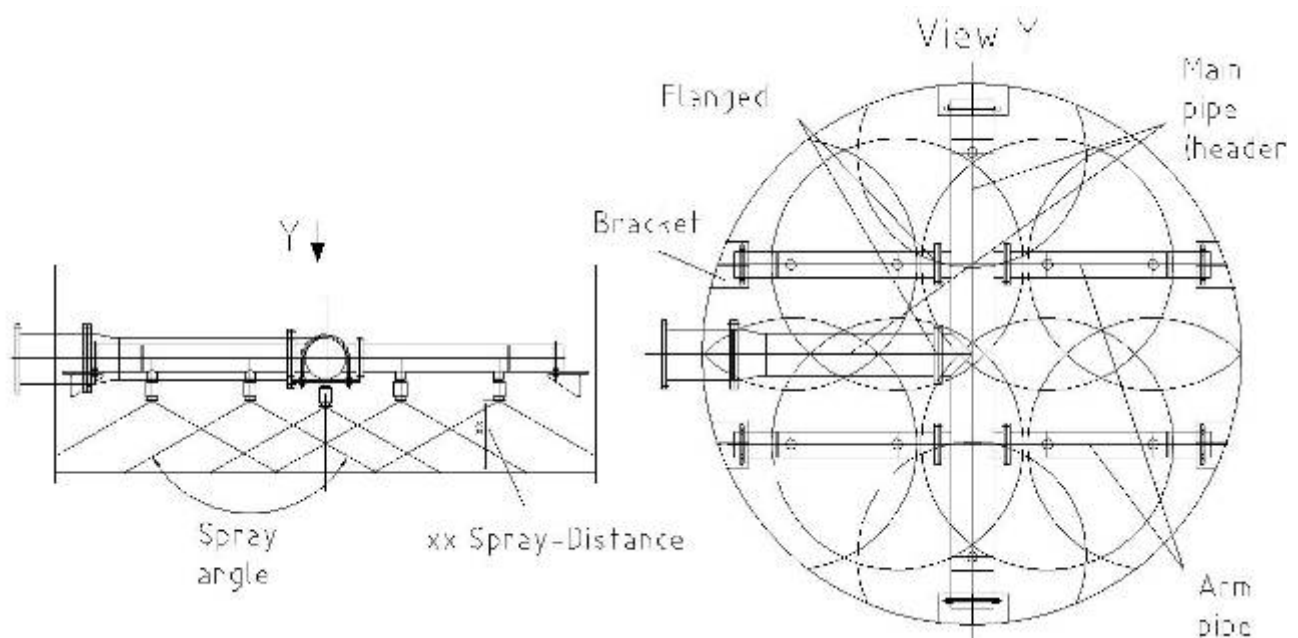
End of the pipe sections are to be fixed onto brackets or to be suspended. Bracket bolting to be tighten.



7.4.2 Installation procedure

Start to install first the main pipe (header).

For all flange connections, gaskets are mandatory. Thereafter install and fit arm pipes to column bracket and header flanges. Make sure that pipe sections are clean. If externally new pipes are fitted a thoroughly flushing with water is recommended prior fitting the spray nozzles. Check and assure that feed supply pipe is fitted with strainers. Check if distance tip of nozzle to the top of packing is in accordance as per drawing.



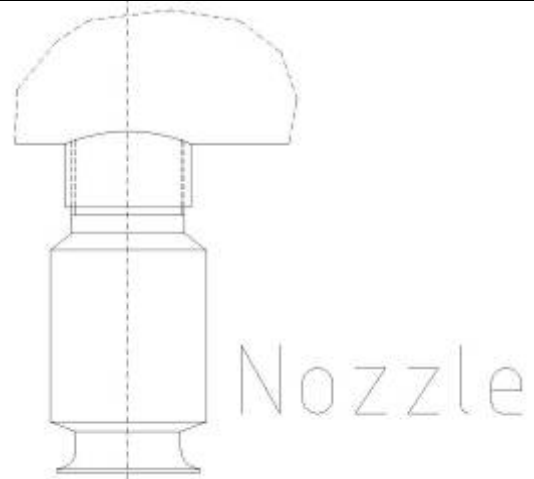
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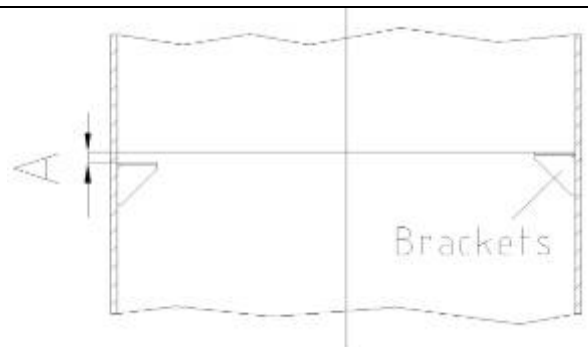
7.4.3 Nozzle installation

Thereafter install spray nozzles. The nozzles to be screwed in tight, check orientation and verticality of nozzles. Some spray nozzle types are fitted with internals (swirls) which might fall out if not carefully handled.



7.4.4 Level check

Check that level is correct $A < 0.3 \%$



7.4.5 Securing

The screw arrangement must be secured with locking nuts (tack welds to be avoided).

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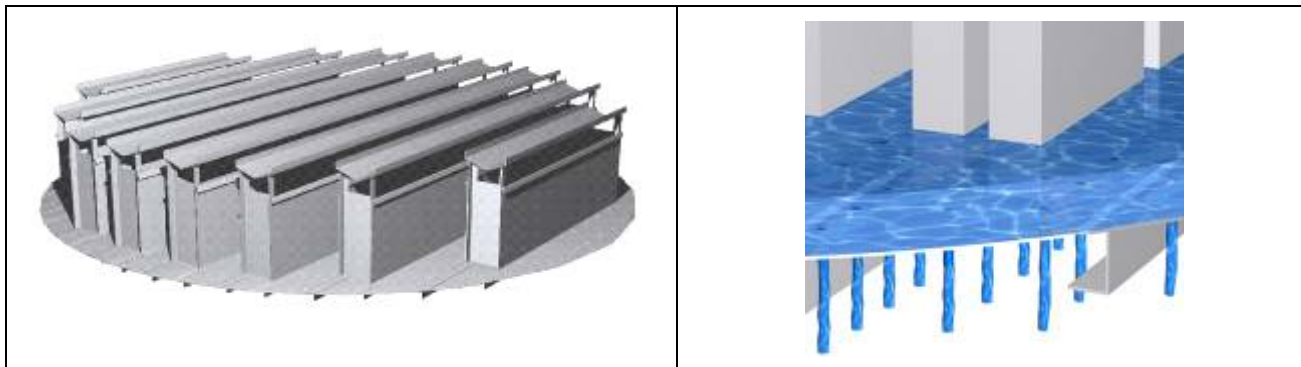
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8 VS Collector / Distributor

VSI Collector / Distributor

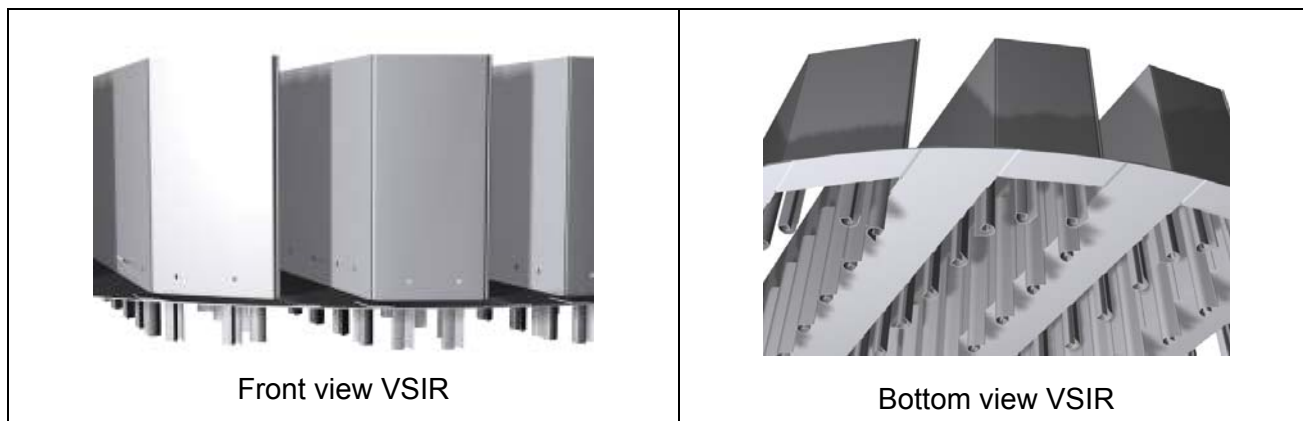
Detail of discharge system (VSI)



The VSI Distributor/Collector is used to collect and redistribute liquid between packed beds. VSI for ID > 800 mm are supported on a ring. For smaller ID the system is installed between column flanges.

8.1 VSIR Collector / Distributor

For higher turn down more than 1 to 3 lateral conducting pipes can be used.



Front view VSIR

Bottom view VSIR

8.1.1 Design concept

The VSI is built in segments and can be installed through manholes. The segments have to be bolted together during installation. It is a tray design, clamped and supported on ring with chimney types. The gas risers are positioned between drip points.

8.1.2 Installation procedure

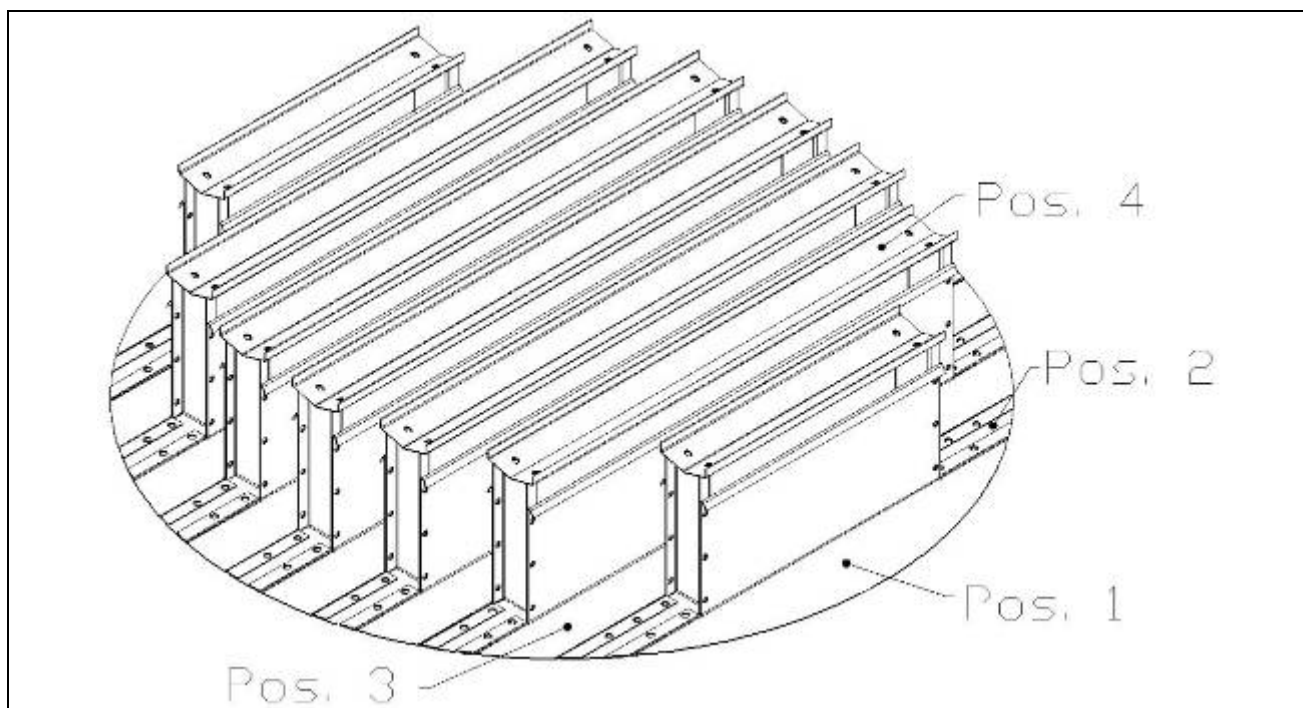
The support rings have to be in one piece and not interrupted. For not closed rings it is important to fill them to minimise wall leakage.

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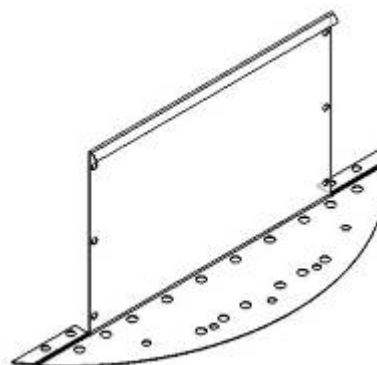
3D view of VSI



Chimney side end

Pos. 1:

Start to install the chimney side end (Pos. 1). Place the segment to the ring and fix it with the clamps. Do not tight the clamps at the beginning.



Front and back side segment

Pos. 2

Bolt the front and back side segments to the chimney side end and fix it with the clamps to the ring. (Bolt Pos.1 and Pos.2 together)



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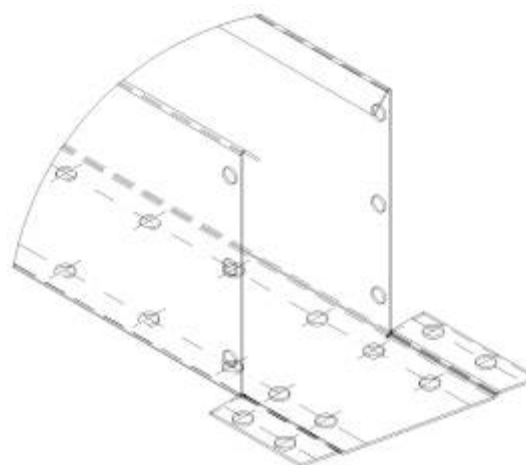
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Chimney side intermediate segment

Pos. 3

Attach the chimney side intermediate segment to the front and back side segment by bolting and fix it with the clamps to the ring. (Bolt Pos.2 and Pos.3 together)



Chimney cover

Pos. 4

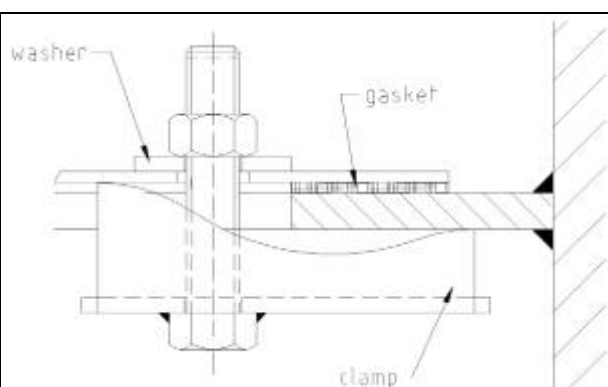
The standard design of VSI distributors includes bolted gas riser covers used to collect and redistribute liquid. Bolt the cover at the end to the front and back side segments and check that it covers the gas risers.



Sealing

Glasfiber gaskets between ring and VSI are used for sealing.

At the end tight all clamps securely.



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8.2 VSI (ID < 0.8m)

In towers with ID less than 0.8m, a one-piece design of the VSI is used with installation through a body flange.

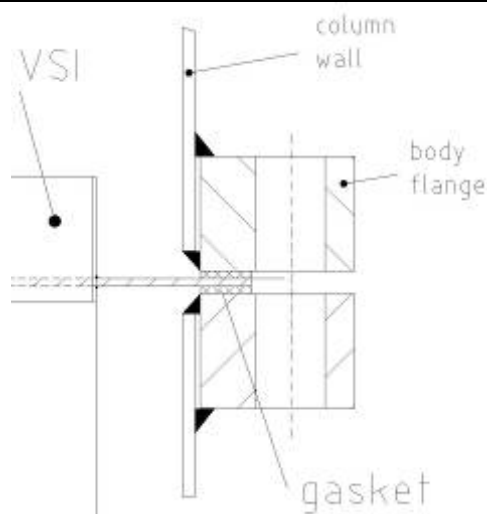
With this design the VSI does not need gas risers as gas passage is provided in the gap between the VSI and the vessel wall.



8.2.1 Design concept and installation details

One-piece design for installation through a body flange. The standard connection to the tower is by trapping the VSI ring between body flanges.

Gaskets are supplied by others.



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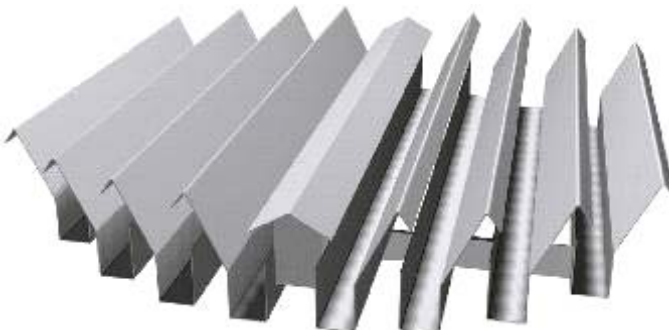
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9 Collectors

9.1 SLR / SLM Collector

The collector SL is used as a separate unit to accumulate liquids from packed sections within a column. This collector requires a ring channel welded to the column wall.



9.1.1 Design concept

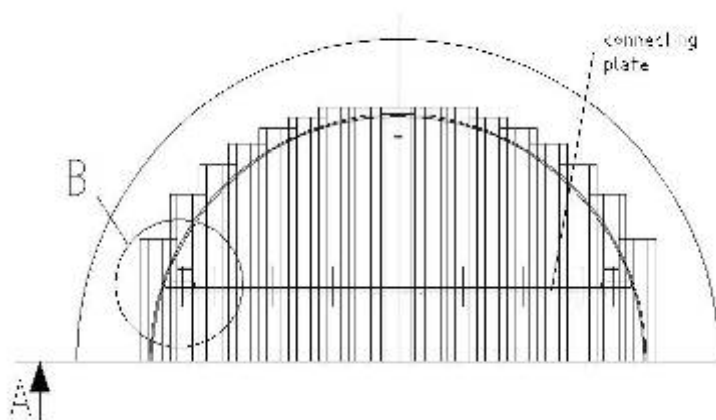
The SL collector is built in segments and can be installed through manholes. The segments have to be bolted together during installation.

9.1.2 Installation procedure

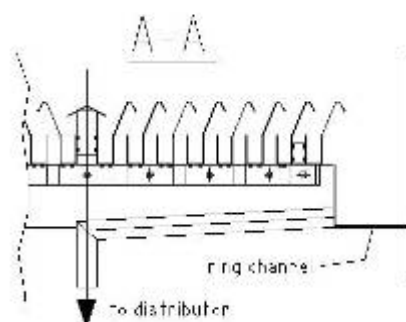
Make sure that the clips for collector fixation welded to the ring channel are positioned correctly. The installation for SLR/SLM collector can be done only from below. Start to bolt one of the two connecting plates to the ring channel. Install first the smallest segment from below and bolt it to the connecting plate. Thereafter install the next segment and so forth. At the end fix the second connecting plate to the ring channel and bolt it to the collector also. The fixation of the segments has to be according the following details. At the end check that the collector overlaps into the ring channel.

9.1.3 Fixation of the segments

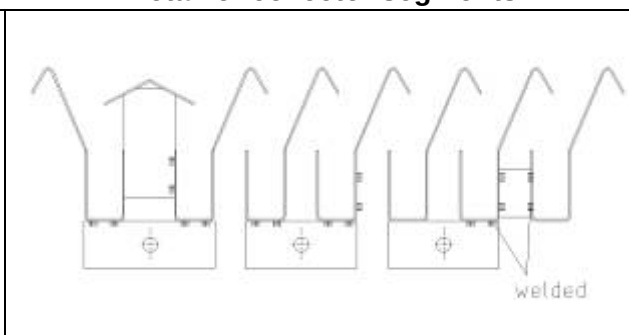
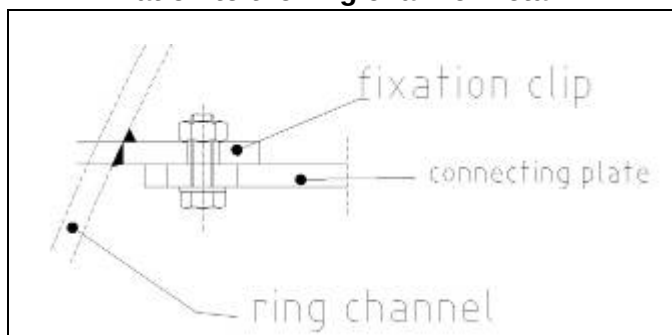
Top view



Fixation to the ring channel Detail B



Detail of collector segments

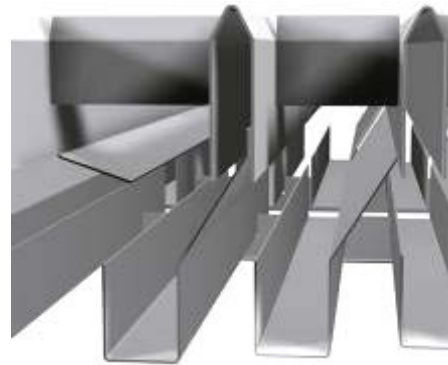


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9.2 SLRT / SLMT Collector



Detail

The collector SLRT/SLMT is both, a packing support and a vane collector. As a packing support, it can support the direct load of packings. For some packings, additional drip plates are used.

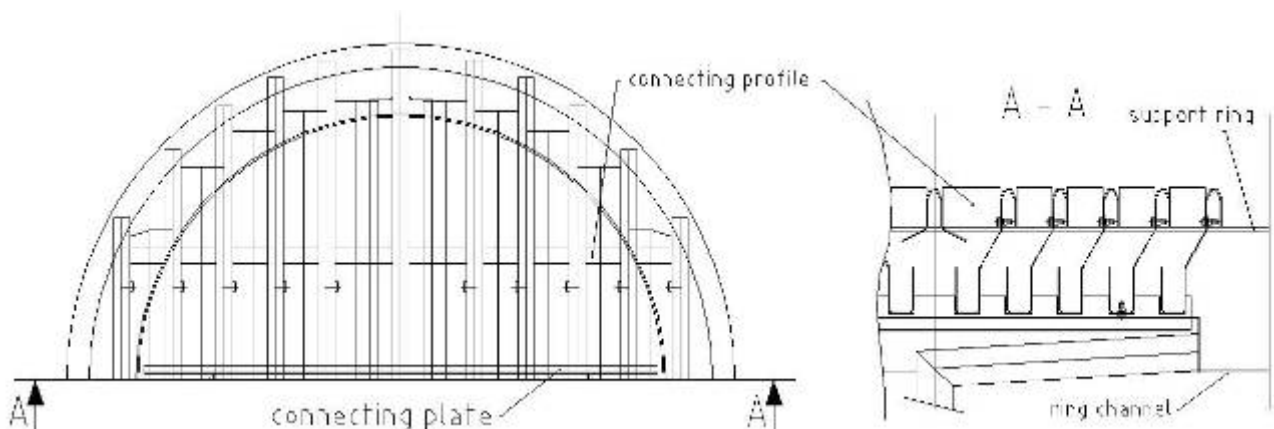
9.2.1 Design concept

This non-welded collector is often used in applications where space between packed beds is critical. This collector requires a support ring inside the column. It can be installed through manholes.

9.2.2 Installation procedure

The segments will be placed on a ring inside the column. Install first the two smallest pre-assembled segments and bolt the connecting plate to the collector. Then install the other segments in the middle part. To fit them together use the connecting profiles. The connection profiles could be deformed (the flanges are pressed together) and pushed into the connection notch. After releasing the flanges, the connection will be fixed on place. It will be recommended to use an opening lockable tong to push the flanges together. (for more details see installation procedure of TSB support grid.)

9.2.3 Fixation of the segments

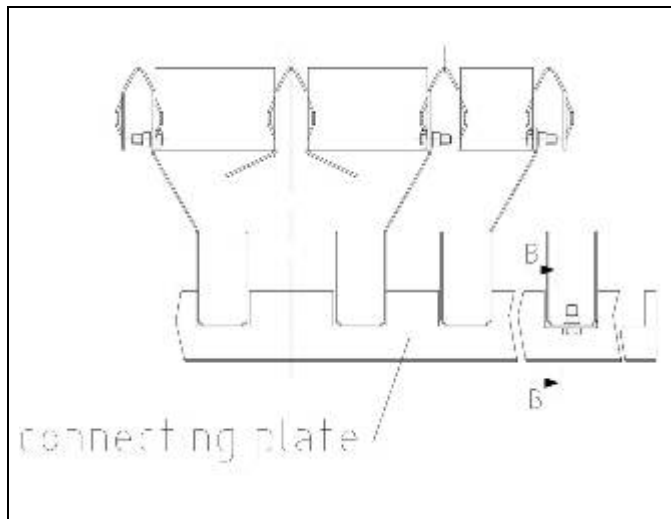


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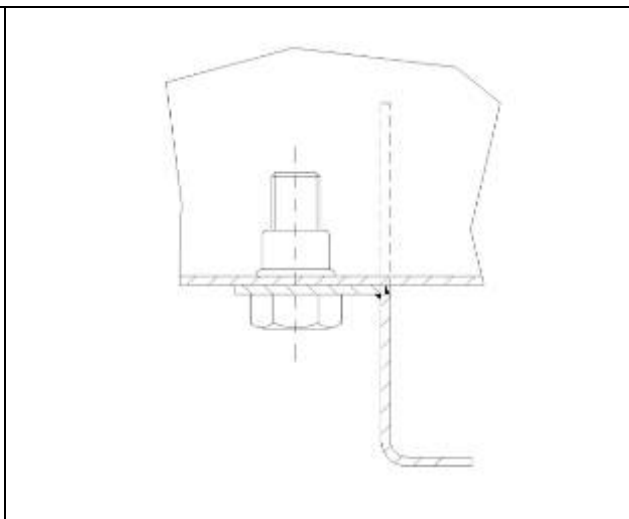
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Detail of collector segments



Section B – B (Fixation of connecting plate)



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10 Chimney tray collectors

Chimney tray collectors are used to collect liquid and distribute vapour below packed beds. Depending the function of the chimney tray it can be welded for sealed usage or it can be bolted for applications with allowed small leakage.



10.1.1 Design concept

Joint construction details are variable depending on the degree of leakage allowable. Both gasket and seal welded construction are available for deck sections as well as for attachment inside the column.

SKI Chimney tray collector: bolted construction
SKIW Chimney tray collector: welded construction

10.1.2 Chimney cover

The cover of the chimney is influenced by operation of the column.



only seal with vapour counter flow



100% seal, also if there is no vapour flow in column

10.1.3 Installation Instruction

The support rings have to be in one piece and not interrupted. For not closed rings it is important to fill them to minimise wall leakage.

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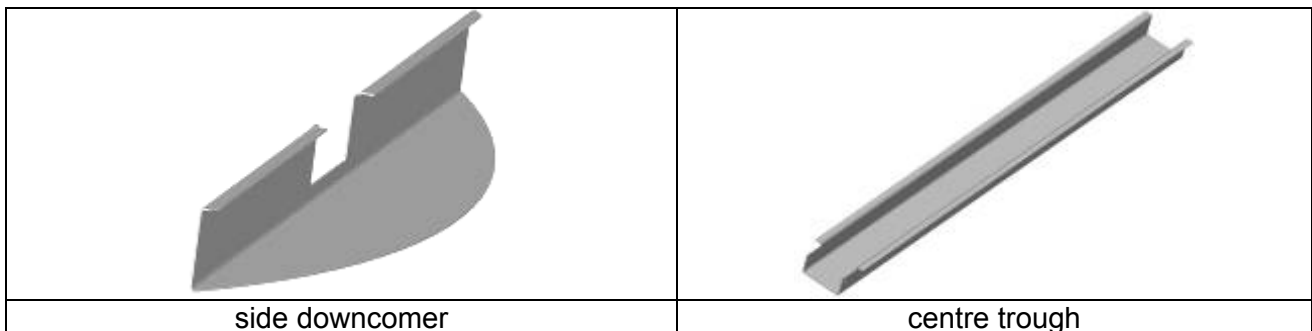
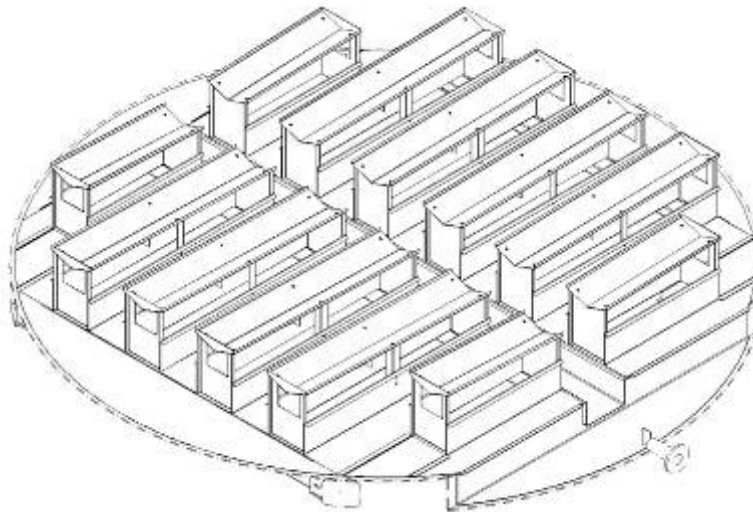
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10.1.4 Installation procedure for welded chimney trays

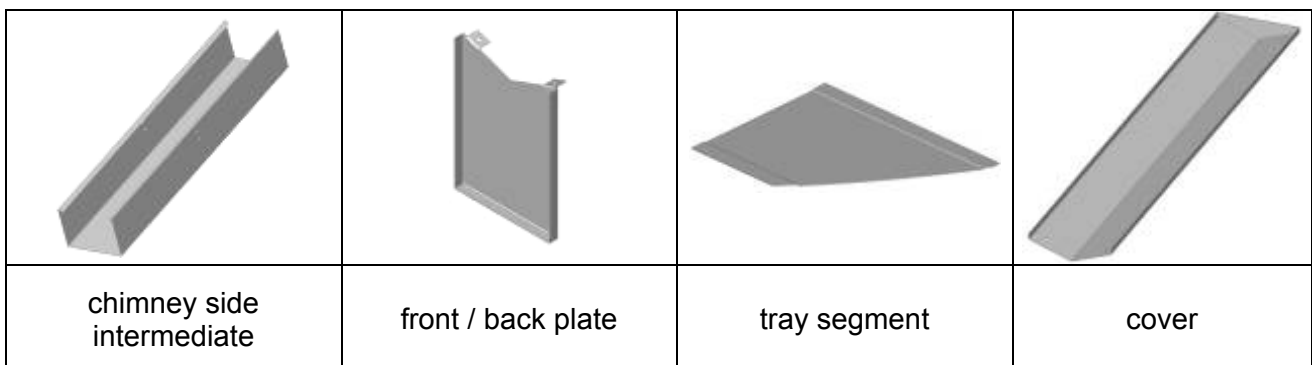
Welded trays have to be seal welded during field installation.

10.1.5 Items of chimney tray

3D view



The chimney sections installation must be started with the sump parts first, which must be aligned in central position and attached by tack welding.



After all beams, risers (gutters), covering plates and side plates are positioned and aligned, start with seal welding.

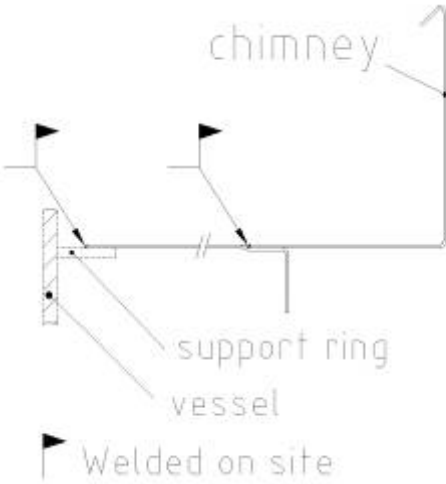
To avoid leakage's check that there are no gaps at the corner of risers etc. and all seal welding is performed.

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The covers (hats) have to be installed to the correct slope and flow direction. If the chimney covers are very high, it is possible to seal weld them from below.

Chimney tray has to be seal welded to support ring during field installation Note: Because of reasons like column shell out of roundness or miss fitting/positing of chimney part sections, gaps might occur. Big gaps must be covered with steel plates (thickness 2 mm) or close welded with weldments.	
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When seal welding the chimney trays and downcomers the following instructions are important:

- seal weld sizes must be kept to the minimum necessary to effect liquid tight joints
- the heat build up must be kept to a minimum to reduce plate distortion.
- welding must start from the centre progressing forward the side.
- the last weld must be the welding on to the support ring or vessel wall.

10.1.6 Installation procedure for bolted chimney trays

First place the glasfiber gasket onto the ring and start to install the sump parts first, which must be aligned in central position and fix them with the clamps. Do not tight the clamps at the beginning.

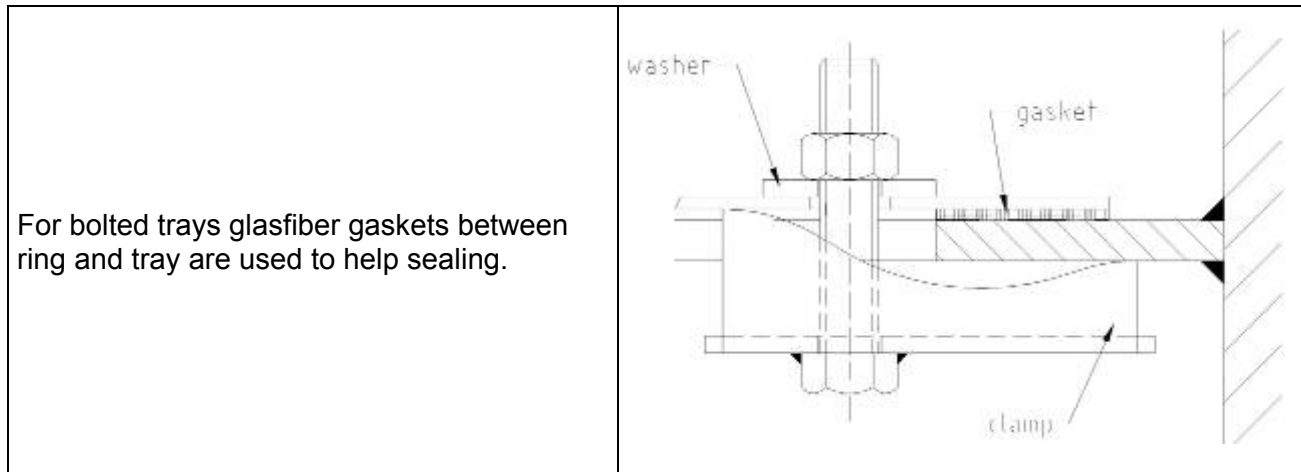
Then install the segments which are close to the column wall and fix them also with the clamps. Bolt together all tray segments and make sure the tray is aligned correctly. At the end tight all clamps securely and fix the covers to the front and back side segments.

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10.1.7 Sealing with gasket



10.1.8 Leakage

The leakage of a chimney tray is defined as an allowed amount of liquid of the operating flow. The amount of leakage is also a function of the liquid level on the deck. During operation, the leakage will decrease because the gaps can be potentially filled with process debris (column scale, solids from the feed, corrosion products etc.).

10.1.9 Leakage test of chimney tray (Water test)

- To verify the leak tightness of seal welded chimney trays a water test with Sulzer supervision is recommended.
- Blind all outflow pipes and fill up the tray with water. The level for the test should not exceed the existing level during the operation.

Chimney tray design	Allowed leakage rates
Bolted metal to metal (without gaskets) design (SKI, SKH)	100mm / min. @ initial filling height of max. 300 mm
Bolted design sealed with gaskets (SKI, SKH-Standard)	10mm/min. @ initial filling height of max. 300mm
Welded design (SKIW, SKHW)	4mm/min. @ initial filling height of max. 300mm

Note: After testing the plugs must be removed.

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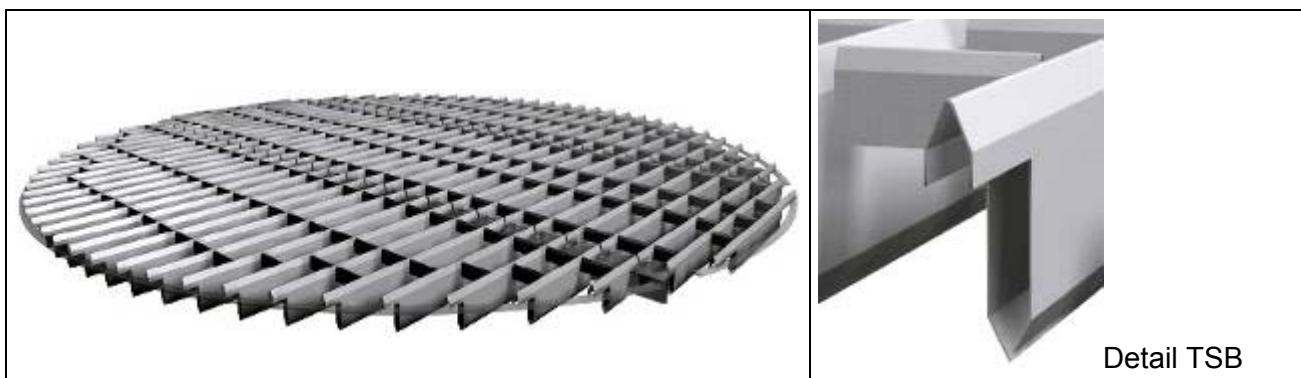
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11 Support Systems

The support system must hold the operation load of packing including hold up and the dead load. If the distributor is remained on the packing it must also hold the load of the distributor and the locating system.

11.1 TSB support grid

The TSB-support grid is an universal support system made 100% with sheet material. It is a non welded design. The main profiles are connected with connecting profiles.

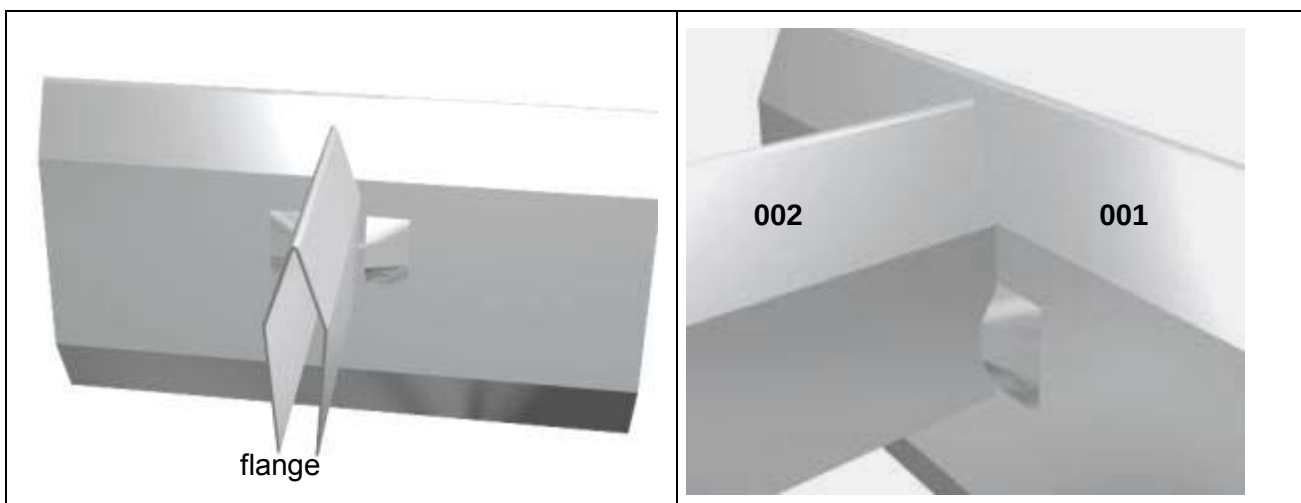


11.1.1 Installation - Instructions:

The main-profiles (**001**) of TSB will be placed first on a ring inside the column. To fit them together use the connection profiles (**002**).

The connection profiles could be deformed (the flanges are pressed together) and pushed into the connection notch. After releasing the flanges, the connection will be fixed on place.

It will be recommended to use an opening lockable tong to push the flanges together

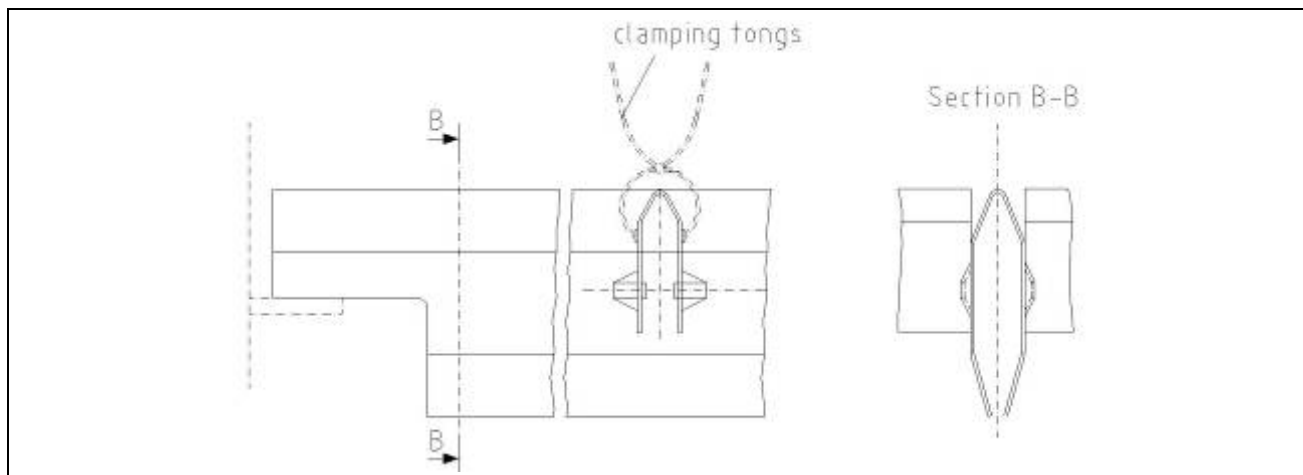


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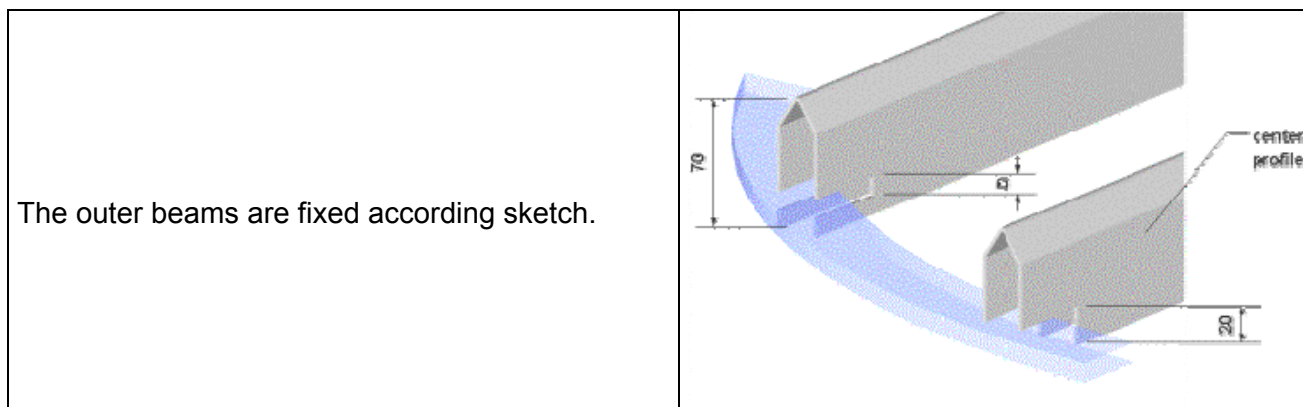
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11.1.2 Example of installing the connection profiles



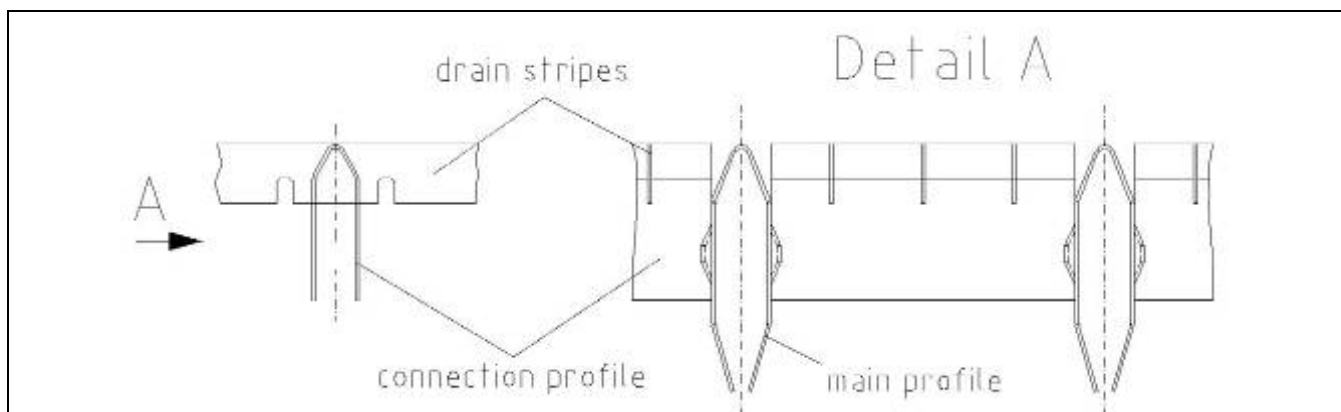
11.1.3 Vertical fixation on ring against uplift or for horizontal transport

TSB support grid can be fixed to rings in the column. The first beam out of centre will be only cut out.



11.1.4 Drain stripes in use with TSB

If the support grid TSB is used with finer packing, additional drain stripes have to be installed. The drain stripes are added between the main support beams on the connector parts.



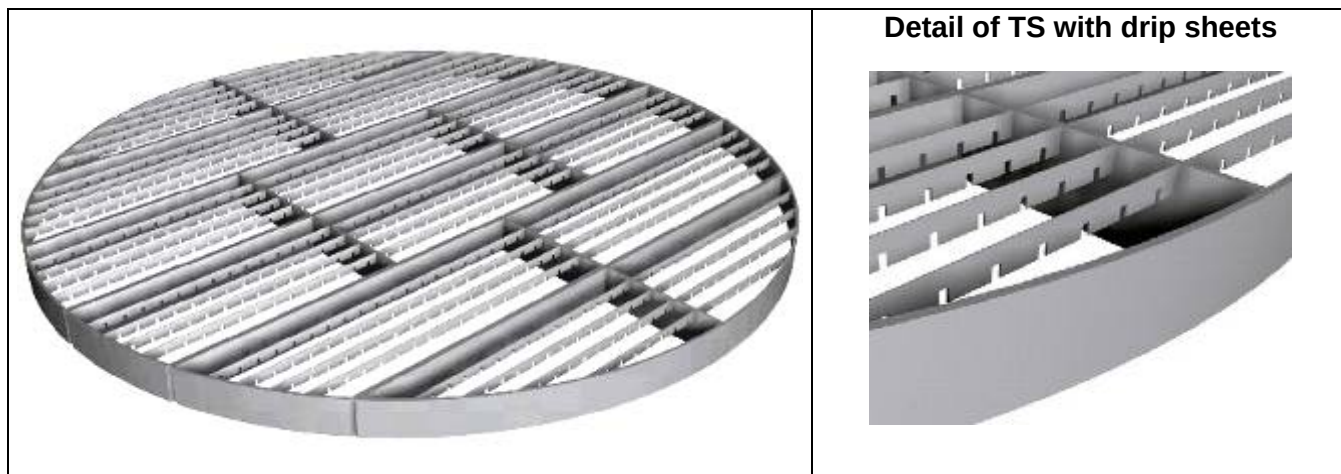
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11.2 TE / TS support grids

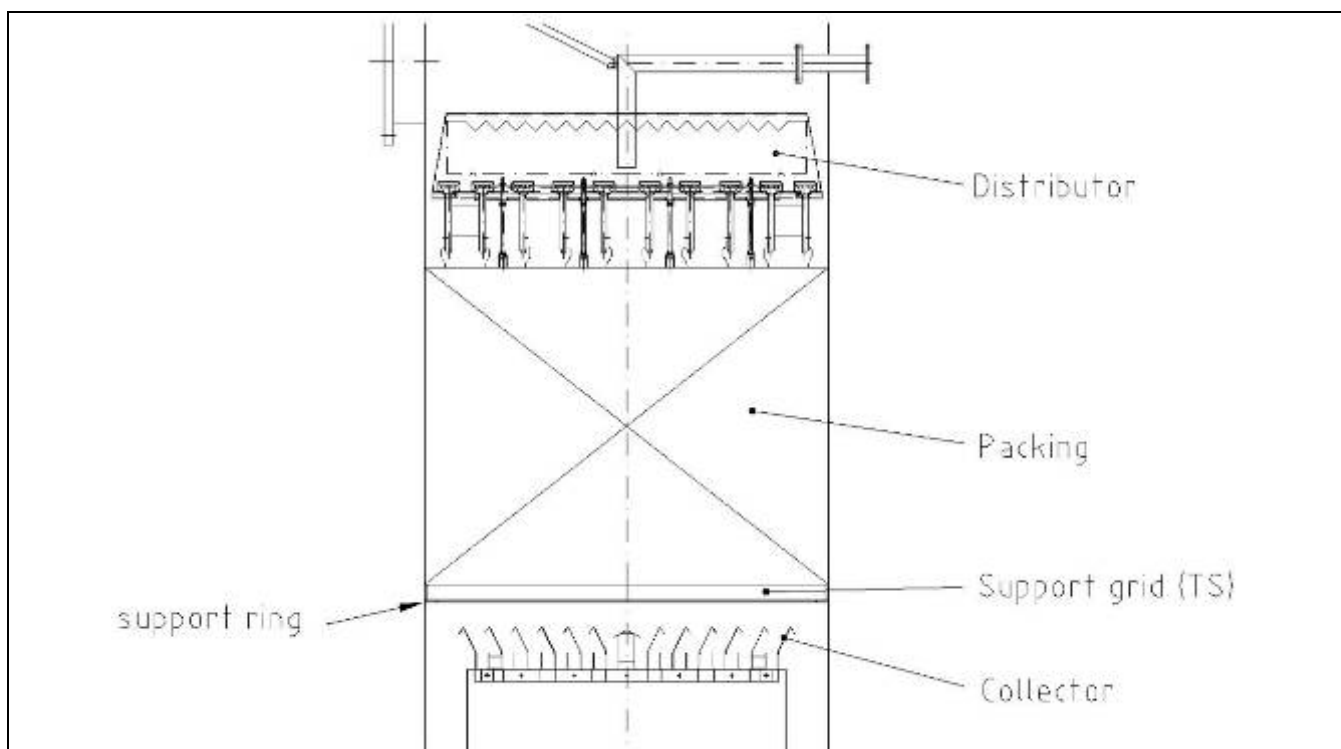
TE and TS-support grids are intended for structured packings with surface area over 350 [m²/m³] packing volume. They are designed with drip plates to prevent premature flooding of the packing. These support grids rest on support rings or gussets welded to the column shell. For columns over 3 meters, additional supports and major beams may be required.



11.2.1 Installation Instructions:

For installation through manhole the support grids are built in segments. Start to install with the smallest segment and place it onto the support ring. Thereafter install the next segment and so forth. For standard use the TE/TS can be positioned on the support ring without bolting. For flanged column the support grid can be built in one piece.

11.2.2 Typical arrangement of internals including support grid



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11.3 GIS support grid for random packing

The GIS Support grid is used to keep random packing supported and for vapour injection. The max. open area 90 to 100% reduces flooding in the gas inlet.



11.3.1 Design concept

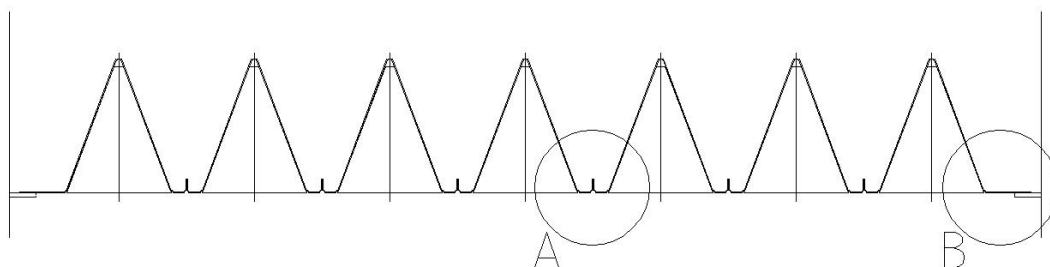
The GIS is built in segments and can be installed through manholes. The segments have to be bolted together during installation.

11.3.2 Installation procedure

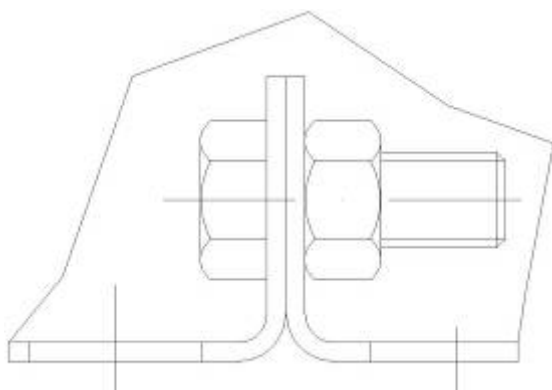
Start to install with the smallest segment and place it onto the support ring. For standard use the GIS segments can be positioned on the support ring without bolting to the ring. Thereafter install the next segment and so forth. The fixation of the segments has to be according the following details.

11.3.3 Fixation of the segments

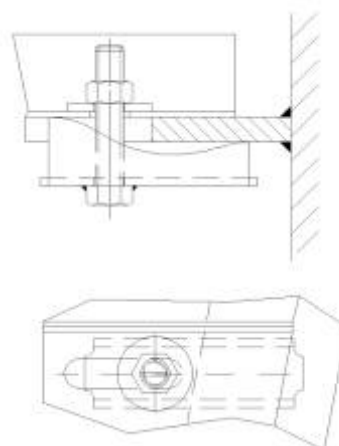
Front view of GIS



**Fixation of the segments
Detail A**



**Fixation on column wall if required
Detail B**



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11.4 EMS support grid for random packing

The EMS Support grid is used to keep random packing supported and for vapour injection. The max. open area 80 to 90% reduces flooding in the vapour inlet.



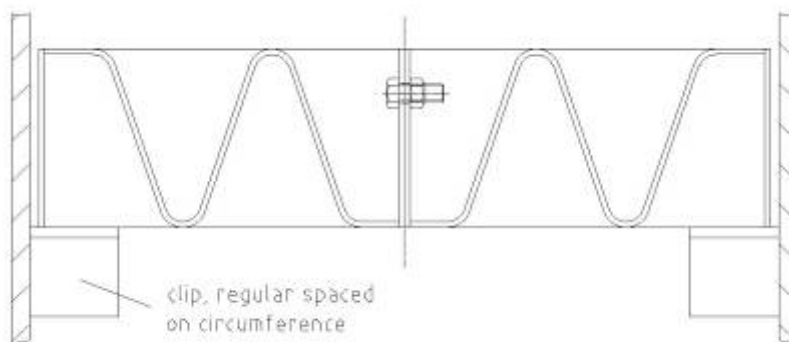
11.4.1 Design concept

The EMS is used for smaller column diameters up to 1.2m. For installation through manhole the EMS is built in segments. The segments have to be bolted together during installation. For flanged column the EMS is built in one piece.

11.4.2 Installation procedure

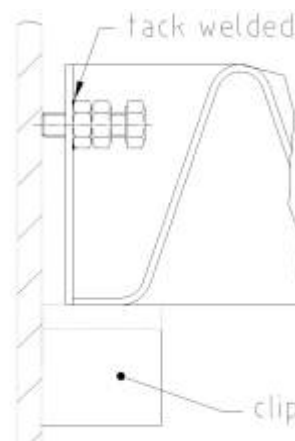
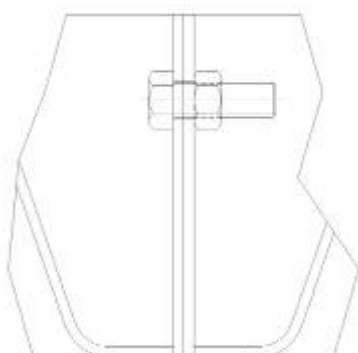
EMS is supported on clips welded in to the column. The clips are regular spaced on circumference. Start to install with the smallest segment and place it onto the clips. For standard use do not bolt EMS to the support clips. Thereafter install the next segment and so forth. The fixation of the segments has to be according the following details.

11.4.3 Fixation of the segments



Fixation of the segments

Fixation on column wall if required



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11.5 RPB Bed Limiter

Retaining grids, consisting of wire mesh welded to the underside of grid frames, are required above dumped random packing beds. Such grids may be either suspended from a liquid distributor above it or bolted to a support ring welded to the column wall.



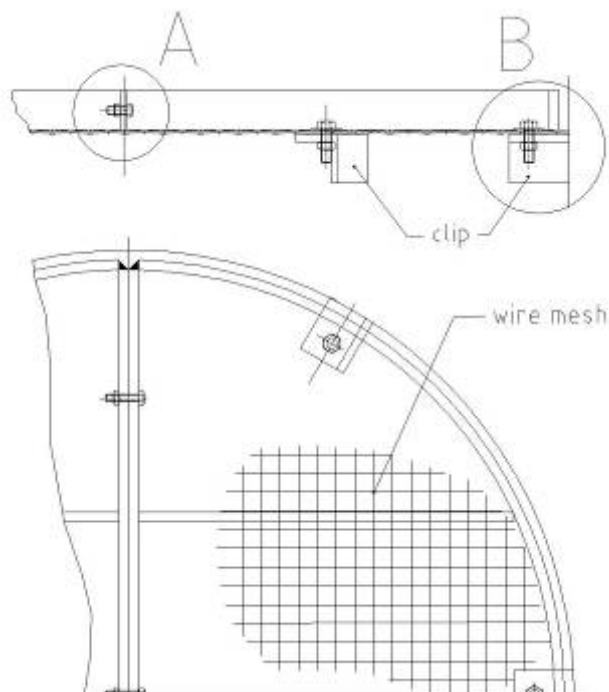
11.5.1 Design concept

Bedlimiters are built in segments. The segments are bolted together and fixed with clips welded to the vessel wall. The bedlimiter also may be fixed on the liquid distributor.

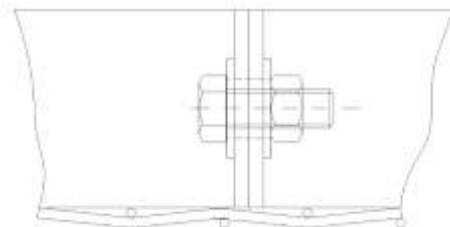
11.5.2 Installation procedure

Start to install with the smallest segment and place it onto the clips. Thereafter install segment 2 and so forth. To provide uplift resistance, this bed limiter is attached to the column wall. The fixation of the segments has to be according the following details.

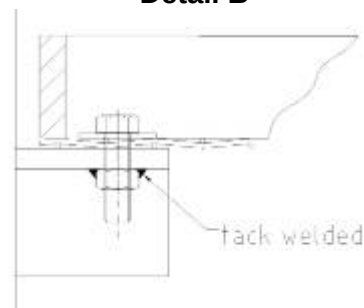
11.5.3 Fixation of the segments



Detail A



Detail B



Section 7

Installation Instructions for Packing

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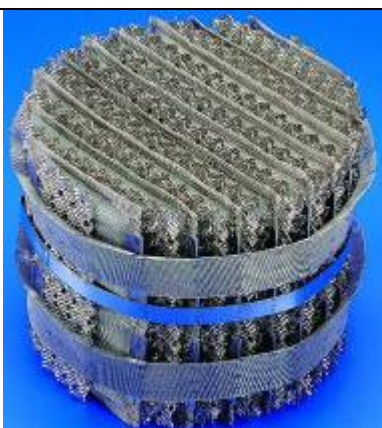
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1 Structured packings from Sulzer Chemtech

The following packings are fabricated in one-piece for small column diameter and segmented for larger column diameter.

The installation instructions depend on the packing material and the fabrication method. The installation procedure for one-piece packing and segmented ones are different.

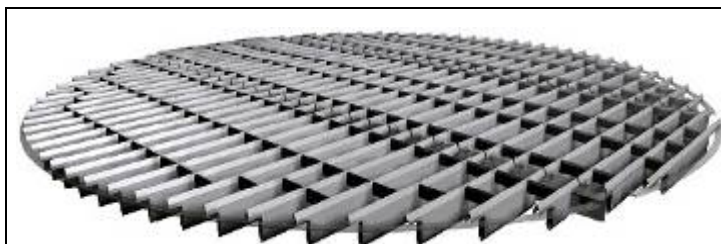
		
Mellapak, MellapakPlus	Mellapak from plastics	Mellagrid
		
BX, BXPlus gauze packing, CY gauze packing	BX gauze packing from plastics	Mellacarbon See T-Hbl - 02
		
DX, EX laboratory packing, DXM, DYM laboratory packing made from sheet metal	Katapak – SP	Nutter ring random packing

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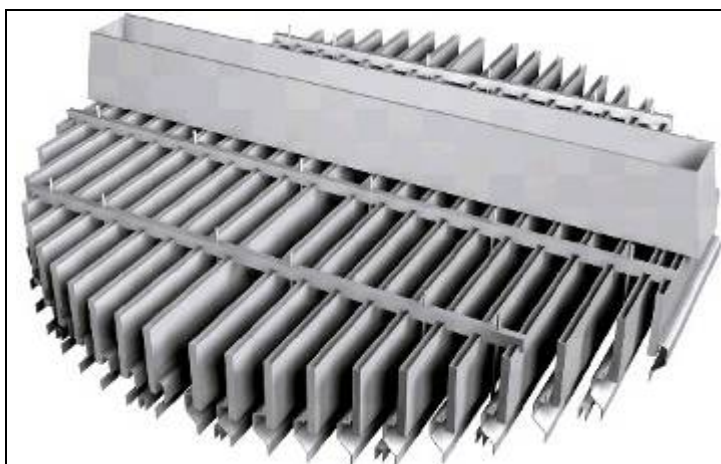
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2 Packing support



In columns made up from body flanged longitudinal sections, the support grids are carried on welded in cams or rings. In monoblock columns, segmented support grids are carried on support beams or support rings. The correct positioning is shown on the assembly drawing.

3 Liquid distributor above top packing layer



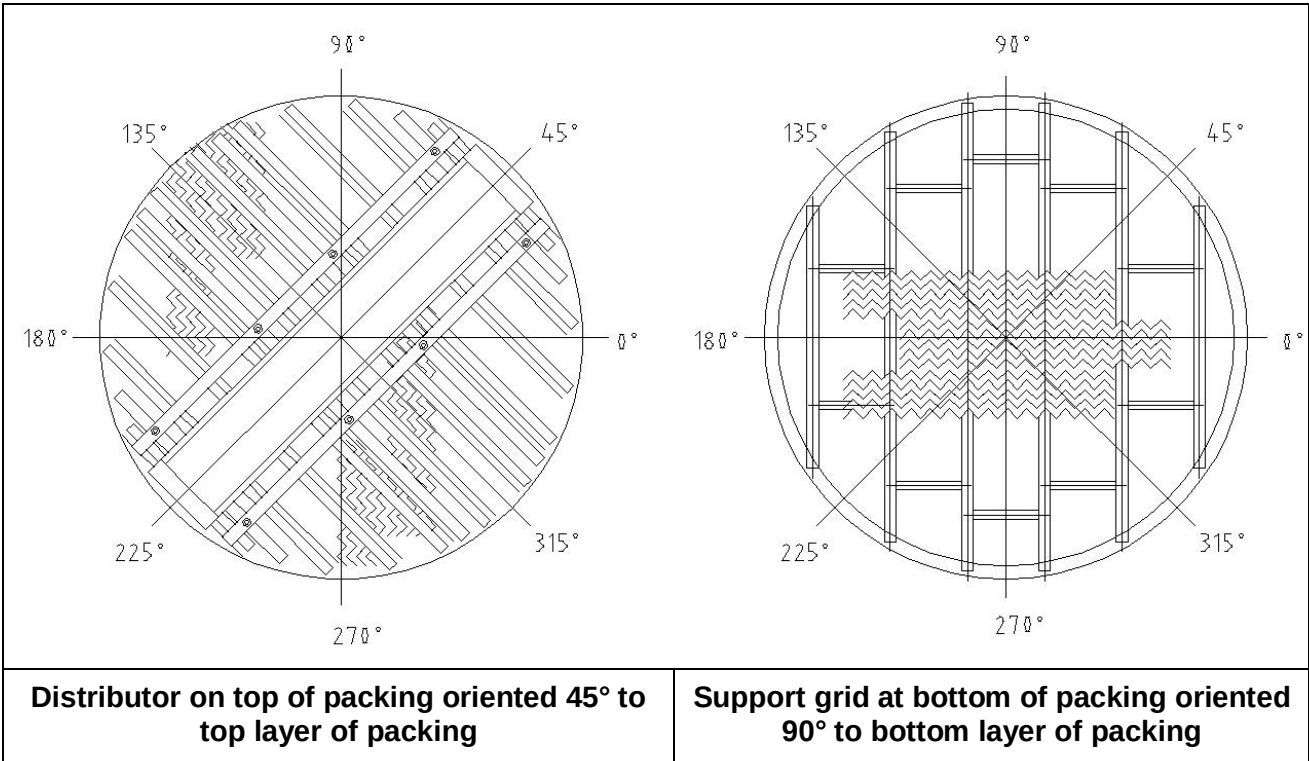
The VEP liquid distributor for example is placed directly on the packing supported by jigs. The correct positioning is shown on the assembly drawing.

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4 Layer direction of bottom and top packing

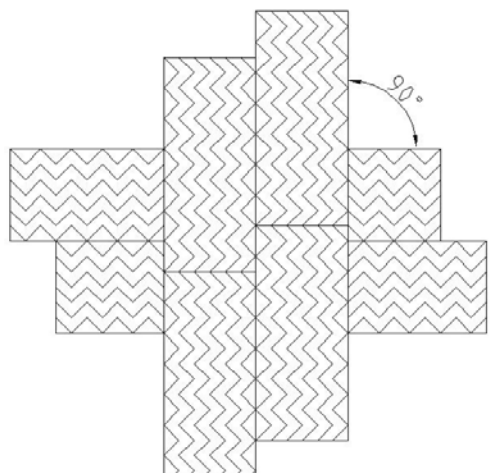


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5 Orientation of packing layers

	Successive packings are always placed rotated by 90° to the previous one. It is important that the collars are close to the column wall. The collars must touch the column wall!
---	---

6 Column internals

Column internals are assembled in accordance with Sulzer Chemtech Installation Instructions (see THbl-04)

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7 General packing installation instructions

The installation should be supervised by a Sulzer supervisor. Sulzer does not take over costs caused by unqualified installation. The performance guarantee is only valid if the installation is carried out under Sulzer supervision. See also THbl-01 for General Safety instructions.



Important:

Because of danger of injury, do not handle packing without protective clothing and anti-cut gloves.

Attention: When welding in the column, no inflammable products should be present, and all necessary safety precautions are to be taken.



Structured packing is fire hazardous!

The use of standard cleaning processes are not a guarantee that all traces of hydrocarbons have been completely removed from used packing. There is **always** the potential for residual traces of material to remain upon any packing even after cleaning has been performed. Due to this risk, any work performed above, below or near a packed bed should always be viewed as work performed next to a potential fuel source. Therefore, no hot work, oxy cutting, welding, grinding, or gouging should ever be performed above, below or near a packed bed. For further details we recommend to contact our Tower Field Service Specialist.

- Packings are only fitted into columns standing vertically upright.
- Field installation can start in the pre-erected monobloc column only after all the piping and welding inside the column has been thoroughly cleaned.
- Fitting rods and metal sheets used as installation aids are supplied with the packing.

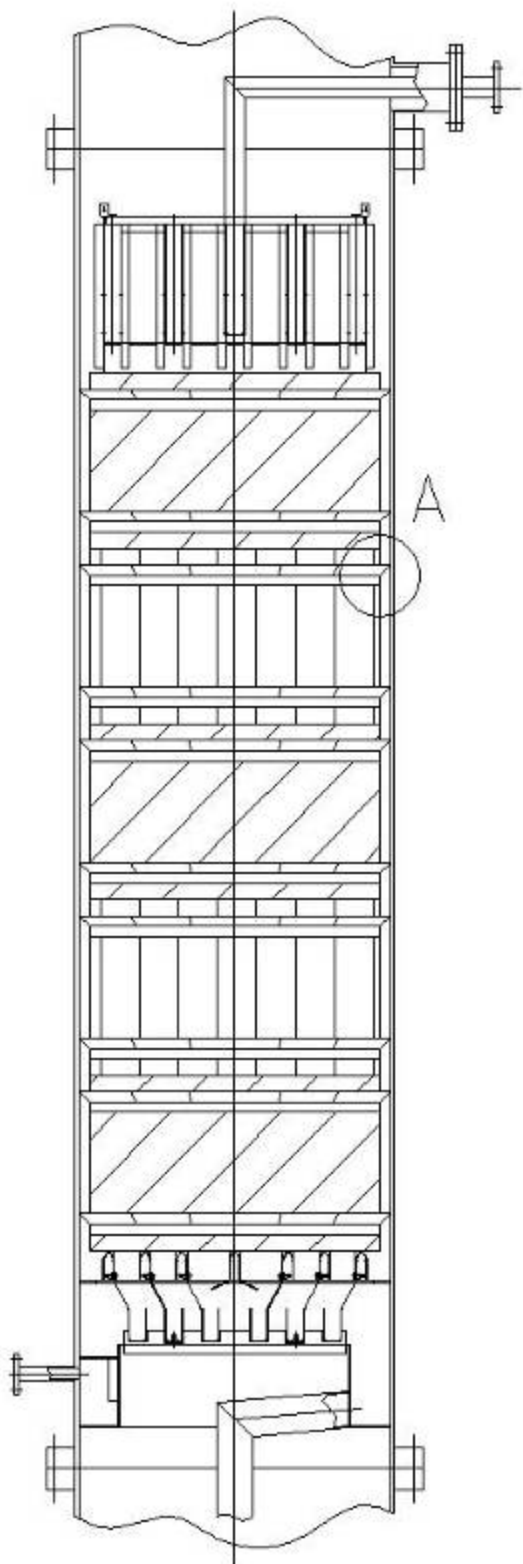
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7.1 Installation instructions for one-piece metal packings

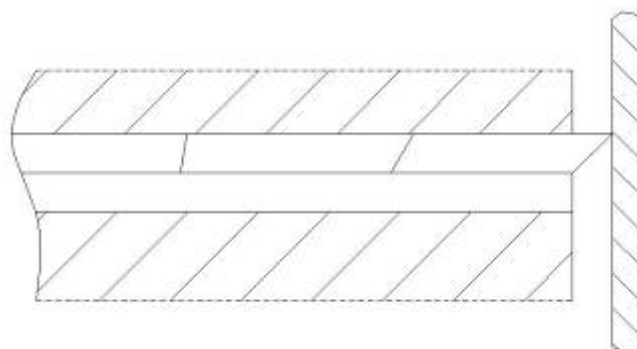
Packing with fixed collars



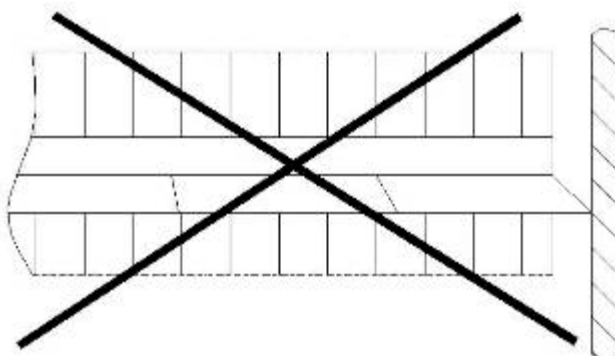
One piece packings have two collars fitted on the circumference of each layer to seal the gap between the packing and column wall. The collars must be bent outwards before installation.

Packing of a diameter over 500 mm should be installed using 3 fitting rods which uniformly support the packing element under the centre band as it is lowered down the column.

Detail A: **CORRECT**



Detail A: **WRONG**



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7.2 Installation sequence of segmented metal packings

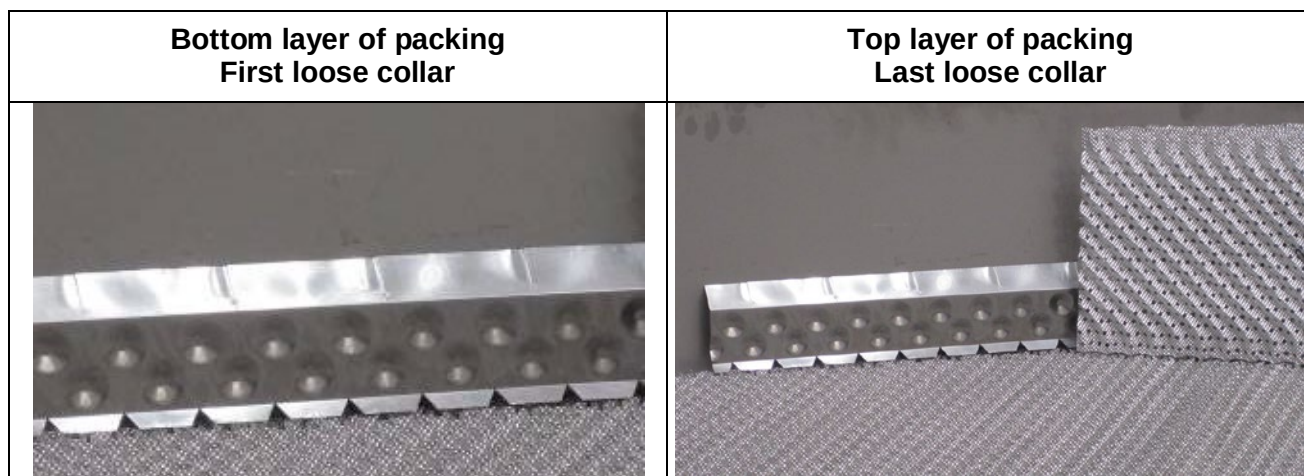
Segmented packings are sealed as standard to the column wall with loose collars. Start the installation of the segmented layer with the head segment. The last segments will then be on the opposite side of the column. The last packing segments are installed with the aid of metal plates. This allows the segments to slide against one another. (See Fig 1)

The gap between the packing and the column wall is given by the loose collar. The Packing segments have to be as close as possible installed at the collar / column wall. Gaps between collar and column wall or between packing and collars have to be avoided.

Possible gaps between segments have to be distributed evenly over the whole cross section. (See Fig. 2)

The loose collars are placed on the circumference of the packing after the installation of the first packing layer is complete.

The collars should have a minimum 20 mm overlap at the intersecting points with the outer segment of the successive packing layer, the loose collar is then pushed to the column wall in such a way that it touches the column wall.



Note:

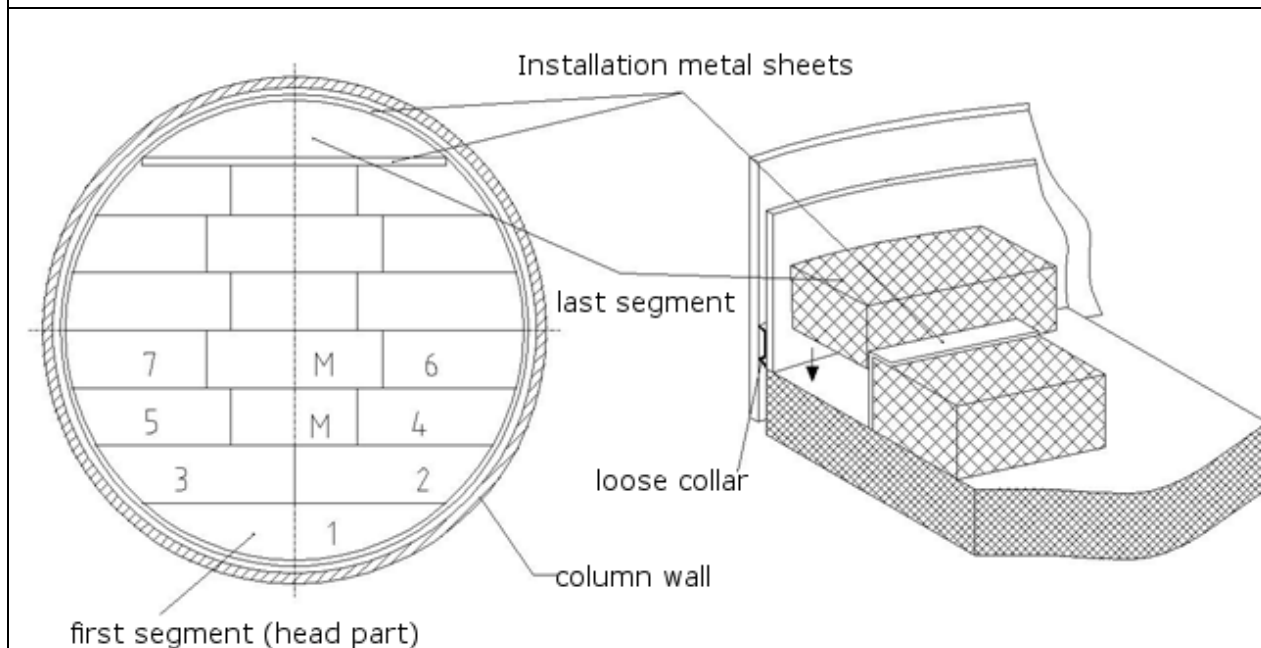
First layer of packing has to be installed without collars. After that every layer of packing has to be installed with collars.

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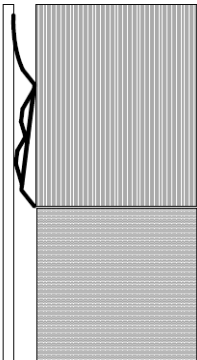
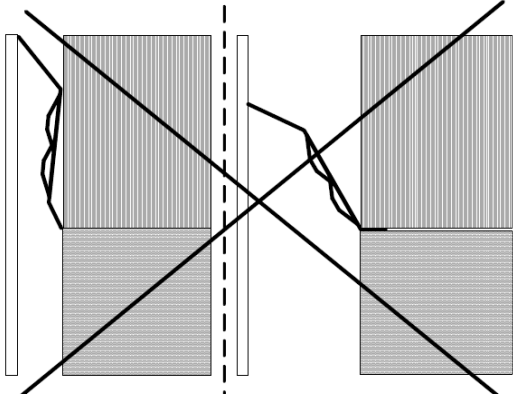
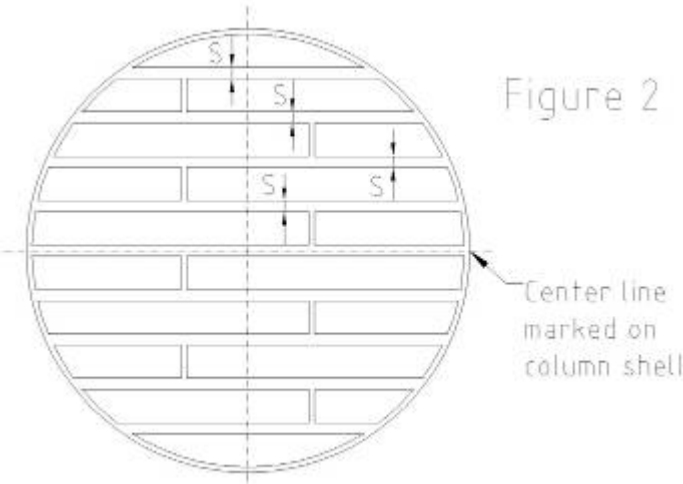
Packing layer installation (Figure 1)



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correctly installed	wrong
	
 Figure 2 Center line marked on column shell	Segment gaps Gap S between segments are to be distributed evenly. Gaps between column wall and collar or between collar and packing have to be avoided.

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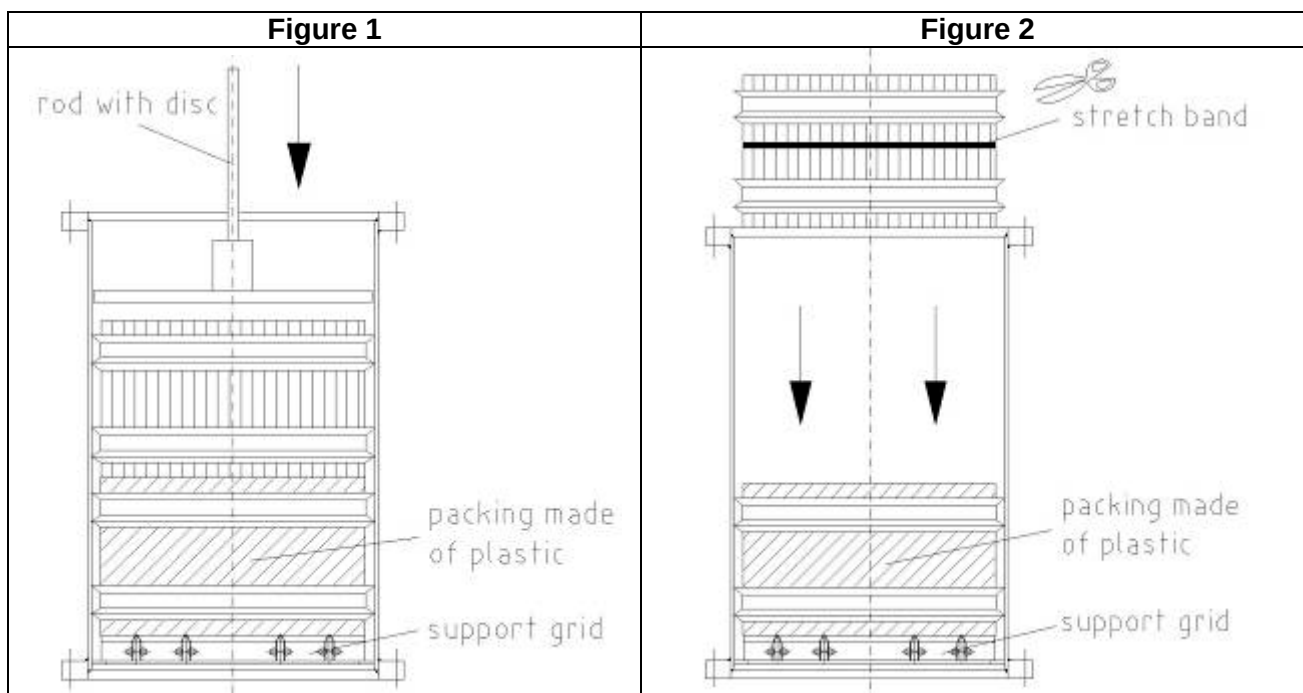
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7.3 Installation procedure for one-piece packings made of plastic

The same instructions as for metal packings are valid. In addition, the following points have to be considered:

Min. handling temperature: Below a temperature of 10°C plastics materials (e.g. PP, PVDF, PVC etc) are getting brittle and glass-like. The risk of damage due to handling is increasing rapidly. Hence, handling of plastic parts shall be avoided below a temperature of 10°C.

Storage: Do not store Plastic Packings in direct sunlight (UV-radiation)



Packing with stretch band

Figure 1:

Each packing element has two sealing collars, fixed on the packing.

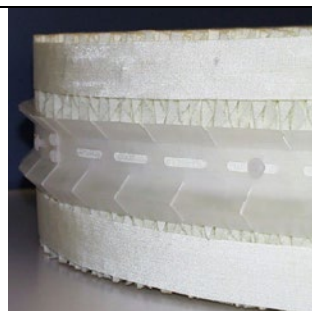
Figure 2:

For column diameters between 550 and 800 mm [22" to 32"] the packing segments are hold together by a stretch band which has to be removed before installation.



Example of sealing collar

The installation procedure is similar as for metal packings. The sealing is done by means of sealing collars. The sealing collars must close the gap between packing and column wall in its entire circumference.



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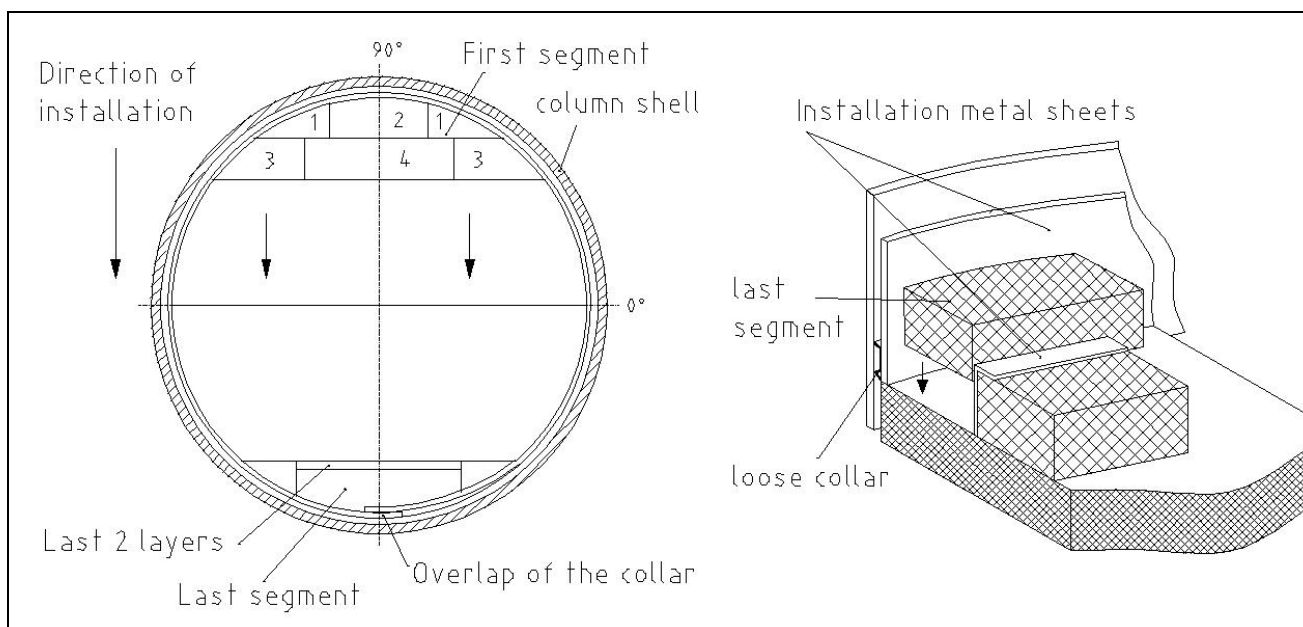
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7.4 Installation procedure for segmented packings made of plastic

The installation procedure is similar as for metal packings.

Sealing of the elements against the column wall is done with loose collars of the same material as that of the packing. The single loose collar pieces have a length of 500 mm [20"], and have to be plugged together to fit the circumference of the column. In addition, the following has to be considered.

Packing element installation



Overlap of the collar at 90° in respect of the direction of the previous packing element layers.

Installation of the packing segments beginning at the opposite side of the overlap of the collar. Begin by putting the edge segments (1) close to the column wall, and then push the segment (2) in between them, also close to the wall.

Last middle segment (at the overlap): take away two layers of the segment, push the segment against the column wall and then insert the two layers again.

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8 Installation instruction for KATAPAK-SP packings made of metal

8.1 Storage and prevention from dehydration:

Just like for the pure catalyst, the following measures should be applied in order to avoid a dehydration of the catalytic packing elements before the installation of the KATAPAK-SP into the column:

- Keep the KATAPAK-SP elements in their unopened original crates.
- Keep crates in a covered warehouse to avoid direct sunlight.
- Do not store the Packing at a temperature below 0°C.

When the installation of the KATAPAK-SP cannot be finished by the end of the day, care must be taken, that the installed KATAPAK-SP elements are kept wet either by installing a temporary pump-around of **demineralized** water or that the column is closed, so that the packing stays in a humid atmosphere.

8.2 Packing installation instruction for one-piece KATAPAK-SP

The same instructions as for metal packings are valid. In addition, the following has to be considered:

- Install the KATAPAK-SP elements in a short as possible time.
- Open only the original wooden crate just before you install the packing.
- Packings are only fitted into columns standing vertically upright.
- Fitting rods and metal sheets used as installation aids are supplied with the packing.

After installation of the KATAPAK-SP layers, flush the packings with **demineralized** water through a flexible hose for at least 2 minutes.

8.3 Installation procedure for segmented KATAPAK-SP packings made of metal

The same instructions as for metal packings are valid. In addition, the following has to be considered:

Install the KATAPAK-SP elements in a short as possible time, to avoid the dehydration as much as possible.

Open only the original wooden crate just before you install the packing. Take out one layer, consisting of several segments and close the crate again to avoid drying of the catalyst.

Transport and lift the single elements with the catalyst pockets in horizontal position and only when you place it on the foregoing packing layer inside the column you turn the segments into its vertical position.

The stainless steel stiffener plates shall be installed between all the segments of the first packing layer of each KATAPAK bed.

Should the elements end up with a gap on the center line of the column, then this gap shall be closed with the loose MELLAPAK layer provided.

Before installing the next KATAPAK-SP layer, flush the already installed packings with **demineralized** water through a flexible hose for 1 minute.

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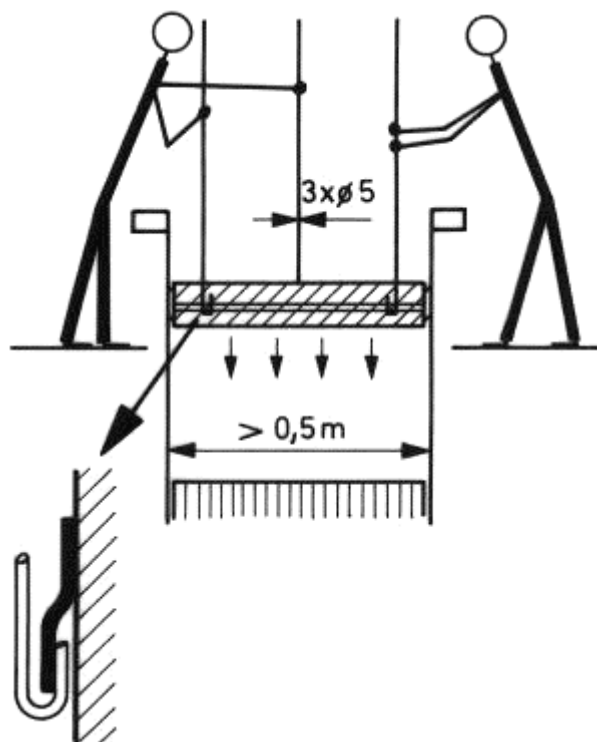
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9 Field installation of packing

General Installation remarks:

- Structured Packing elements are only fitted into columns standing vertically upright. (Exception to this rule: Special packings made for particular applications for fitting into a horizontal column.)
- Do not directly step on the packing surface. Walking is allowed only by using protection sheets with an area of at least 1200 cm² [1.3 ft²]. (sheet-size 2x40x30cm / [1"x16"x12"])
- Each installed layer has to be verified after installation
 - Correct orientation of the layer
 - Evenly distributed gaps over the whole column area.
 - Levelness of the packing (acceptable deviation within column-ID/300 or 0.33% of the column inner diameter)
 - Correct and gap-free placement of collar

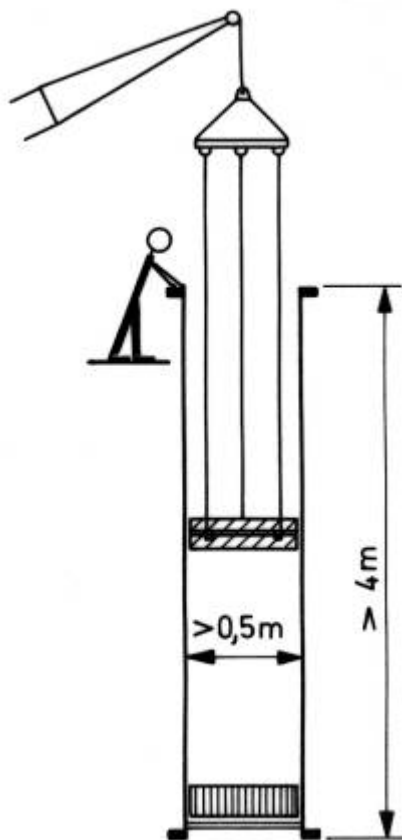
Please use following installation instructions for packings.

One-piece packings Flanged columns $\varnothing \leq 0,5 \text{ m}$ [20"] and length $\leq 4 \text{ m}$ [13 ft] Use a rod with disc for installation.	
One-piece packings Flanged columns $\varnothing > 0,5 \text{ m}$ [20"] and $\varnothing \leq 1,2 \text{ m}$ [47"] and length $\leq 4 \text{ m}$ [13 ft]. Use fitting rods for installation.	

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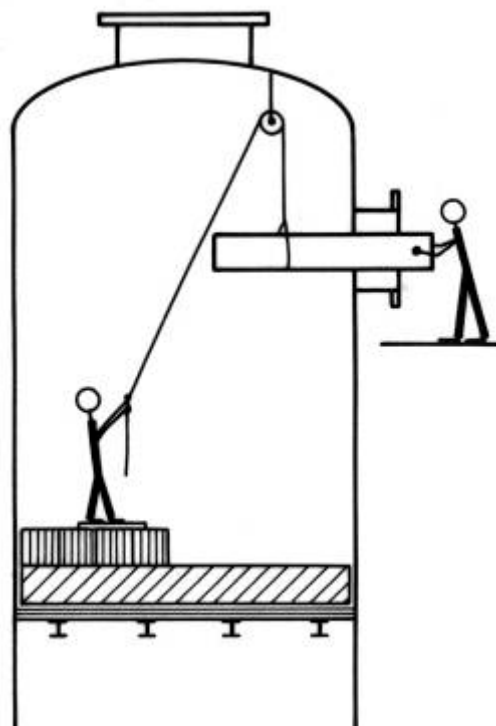
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One-piece packings

Flanged columns $\varnothing \leq 0,8 \text{ m}$ [32"] and length $> 4 \text{ m}$ [13 ft]

Installation by means of fitting rods and crane equipment



Segment packings

Monoblock columns and flanged columns with $\varnothing > 0,8 \text{ m}$ [32"]

Installation through manhole or column flange segment by segment

Special note for KATAPAK-SP:

Transport and lift the single elements for **KATAPAK-SP** with the catalyst pockets in horizontal position and only when you place it on the foregoing packing layer inside the column you turn the segments into its vertical position.

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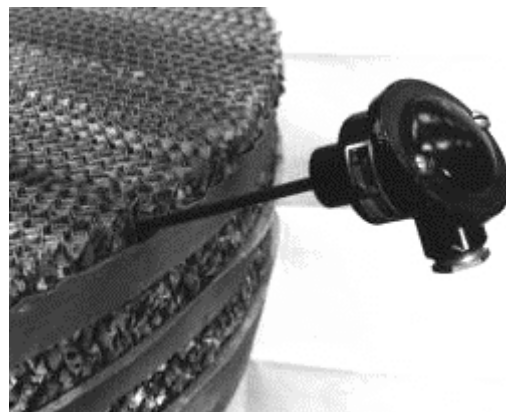
10 Installation of temperature sensor in SULZER-Packings

Via the instrument connection, a hole is to be carefully made into the packing to take the temperature sensor.

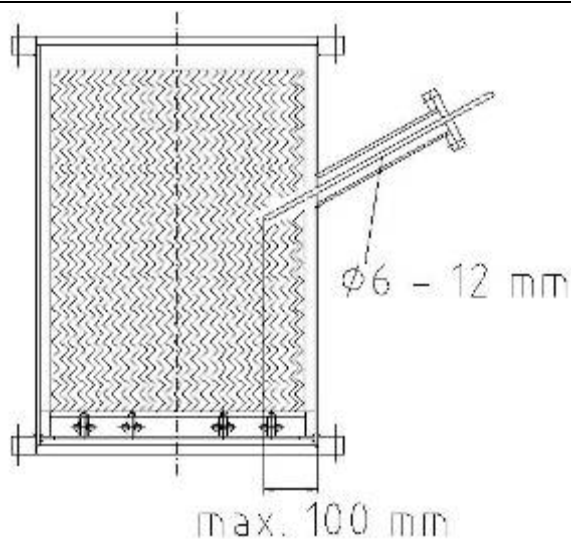


(except for KATAPAK-SP)

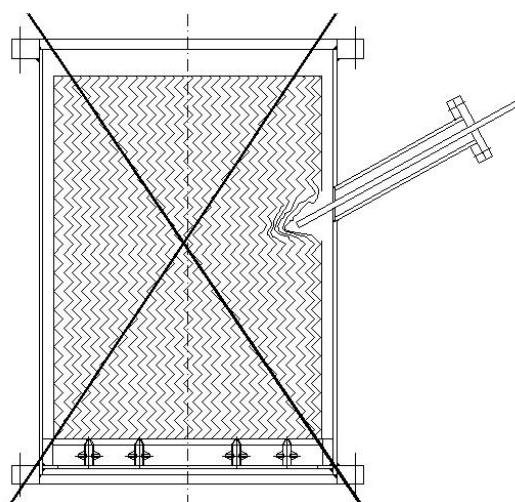
The diameter of the protective tube should be as small as possible (max. 12 mm [$\frac{1}{2}$ "]). The depth of penetration into the packing is not to exceed 100 mm [4"].



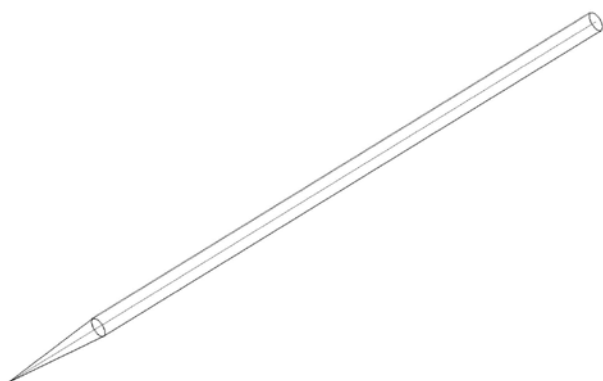
CORRECT



WRONG



10.1 Installation of temperature sensor in Gauze and sheet packing (except KATAPAK-SP)



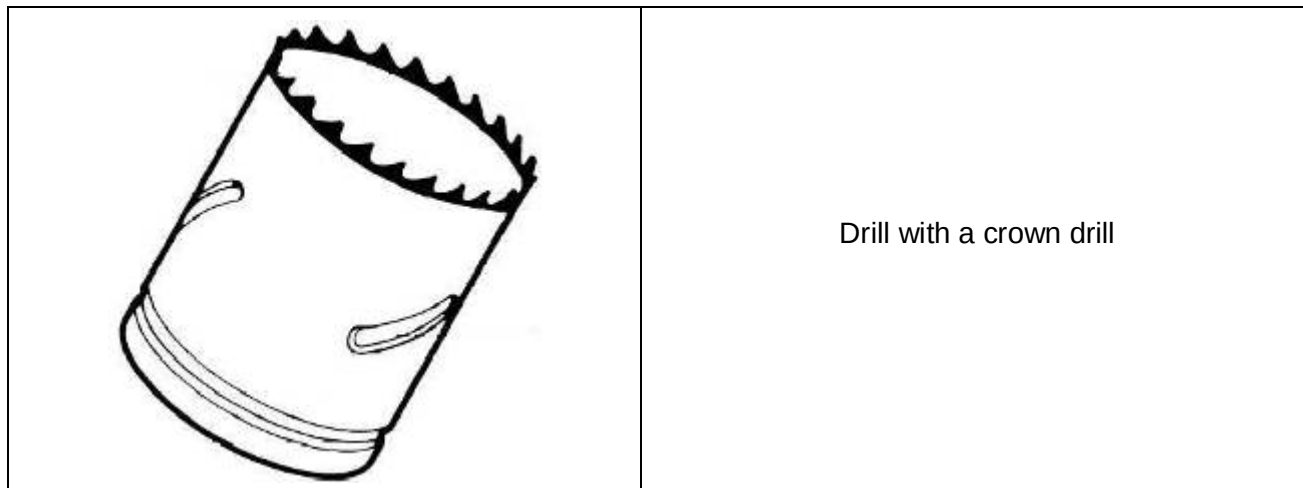
Pierce and broaden out with a pointed round metal bar

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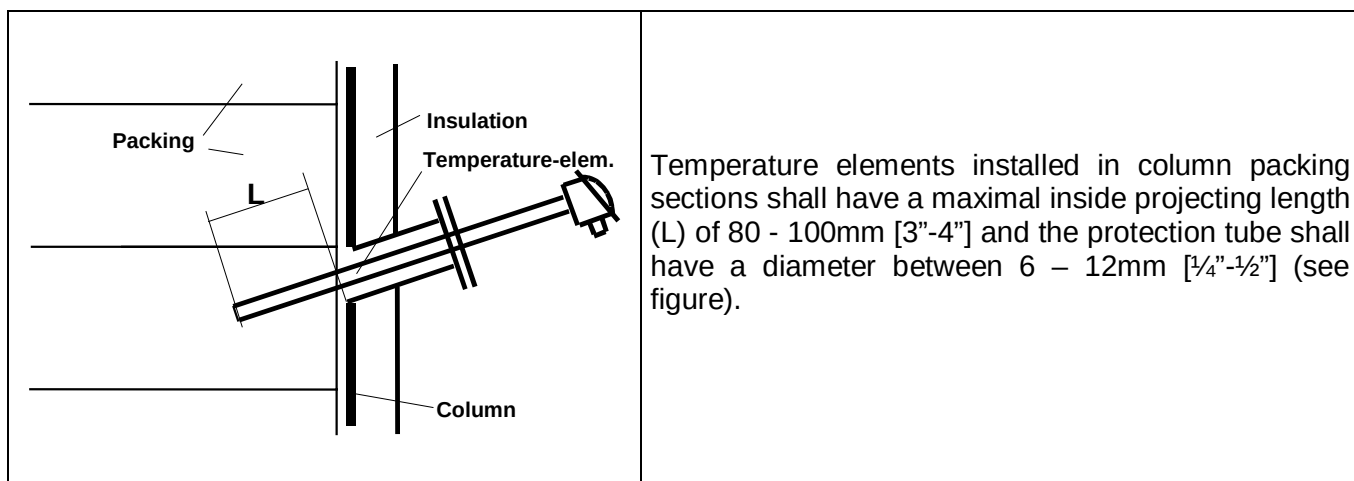
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10.2 Installation of temperature sensor in Packing made of plastic



10.3 Installation of temperature sensor in KATAPAK-SP

When reaching a location of a thermowell / temperature element, then the temperature element shall be installed, just after placing the corresponding KATAPAK-SP element in order to check that the location is correct and the catalyst pockets are not damaged.



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11 NUTTER RING RANDOM PACKING

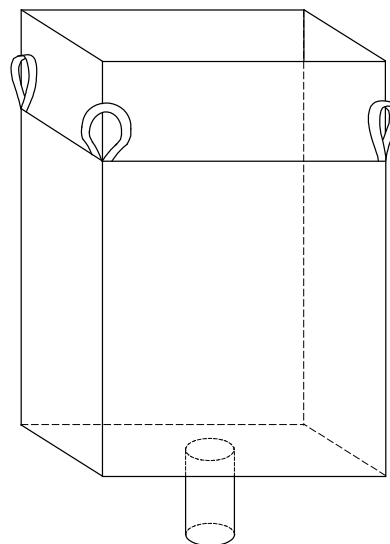
11.1 Initial receipt and storage

Nutter Ring packing is normally transported in 40 cubic foot bags. An inventory check should be made as soon as possible after delivery and a record made of the number of bags supplied. Operational problems have been known to occur because of a lack of control during filling.

Nutter Ring packing is vulnerable to impact damage. Disorganised storage can lead to scattering of packing elements over an appreciable area, and consequently, they can become permanently damaged. Fragmented storage can result in inventory loss.



Storage facilities will be required for the period between delivery and installation. Preferably, this storage will be covered and away from the immediate plant area. Note that carbon steel packing can rust in damp storage areas. Since the presence of iron oxide is normally deleterious to column operation, dry storage should be provided in such cases.



11.2 Column preparation

Before Installation of the internals, care should be taken to insure that the vessel is clean and that pipes leading into the vessel are free of dirt, slag and other debris which could coat or plug distributors and/or packing.

Facilities for hoisting the bags of packing to the working elevation and into the column should be provided by the client or contractor, by agreement. The supply of scaffolding, lifting equipment, and internal walking boards will normally be the responsibility of the contractor or subcontractor carrying out the work.

Only the quantity of packing required for the bed being filled should be taken to the working area. In that way, overfilling (which could occur if the bed was inadvertently compressed during filling), or underfilling (if, for example, previously filled beds had used unexpectedly greater amounts of packing) can be avoided.

Packing support rings should be level and free of weld splatter. In revamp situations, redundant tray support rings need to be cut back to within 3/8" of the vessel wall. Downcomer bolting bars should also be cut back. Packing bed limiter lugs, where installed, should be checked to insure the correct depth of packing can be installed. After installation of the bed support plate, a continuous guideline should be drawn to indicate the depth of packing required, unless this is clearly indicated by the bed limiter lugs or other support means. This guideline should be measured from the top side of the support ring for the packing support plate.

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Packing should be installed through a suitable manhole or other means of access to the packed bed. Where appropriate, nozzles, including those with vortex breakers, should be shrouded to ensure that dropped packing elements and other debris do not enter the pipework.

11.3 Installation of Nutter ring random packing

1. Nutter Ring random packing should be dry packed by dumping the rings from the shipping bag or a chute. The use of a pneumatic filling device is not recommended due to the potential for ring deformation.
2. Where possible, start from the lowest packed bed and work upwards. When this is not practical, or where beds at different levels are being filled simultaneously, adequate protection must be provided for those working below.
3. Ensure that the upper limit of the bed is clearly recognizable. This will usually be indicated by the bed limiter lugs welded to the vessel wall. Where this is not the case, a chalk mark should be drawn as indicated earlier.
4. Nutter Rings can be dry dumped from the top of the bed. Care should be taken to ensure that the elements are evenly spread over the whole cross-sectional area of the column and that a reasonably level surface is maintained during the filling process. The use of a chute and filling sock is recommended in order to break the fall and to allow the elements to be efficiently distributed over the column cross-sectional area.
5. Walking directly on the packing should be avoided since it can cause localized compression and damage. Where the column diameter is such that entry into the column is necessary, walking boards must be available and the supervising engineer should specifically ensure that they are used. The boards should be rigid and used in such a way that the packing elements are not damaged. The utmost care is needed to ensure that the walking boards are subsequently removed.
6. When the desired bed depth is reached, the top of the bed should be levelled prior to the installation of the bed limiter. The bed limiter should lay directly on its supports. The bed should not be compressed to accommodate the bed limiter, nor should there be any gaps greater than 2 packing ring diameters between the top of the bed and the bed limiter.
7. At a suitable time during installation, and in any case upon completion, a count should be made to ensure that all bags have been removed from the column.

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12 Dismantling the packings

The method of removal of the packings depends on the type and diameter of the packing and can be carried out as follows:

One-piece gauze packing and MELLAPAK:

The longitudinal section of the column has to be dismantled and laid horizontally. The individual packings can be removed by applying special hooks to the middle edge band and withdrawn carefully from the section of the column.

Gauze packings and MELLAPAK made in segments:

In the reverse sequence to fitting, i.e. the last edge segment to be fitted is withdrawn by means of special hooks. The remaining segments can then be removed without special tools.

Packings made in one piece, diameter up to 700 mm, made from plastics and carbon:

After suitable safety precautions to loosen the support grid from the column connections, lift off the section of the column vertically and push the packing downwards.

Packings made in segments, of diameter 700 mm and above, made from plastics and carbon:

The procedure is the same as for the gauze packings and MELLAPAK made in segments except that the first edge segment has to be removed with even more care.

Sulzer is prepared to advise the customer regarding possible shutdown procedures and to make its wide experience available to the customer.

However, Sulzer is not able to accept any responsibility for the safety of the installation and of personnel.



Warning:

RISK OF FIRE ! CORROSION !

The packings have to be as cold and dry as practicable before the column is opened. The duration for which the column is opened has to be limited to a minimum. When column is closed for a longer standstill, it should be flushed through with Nitrogen to prevent further corrosion.

In general, the use of Carbon steel packings is only practicable where corrosive influences are not to be expected.

13 Cleaning the packing

There are various possibilities of cleaning packing inside the column or, in emergencies, outside the column.

A few examples:

- with solvent
- with high pressure water/steam jet

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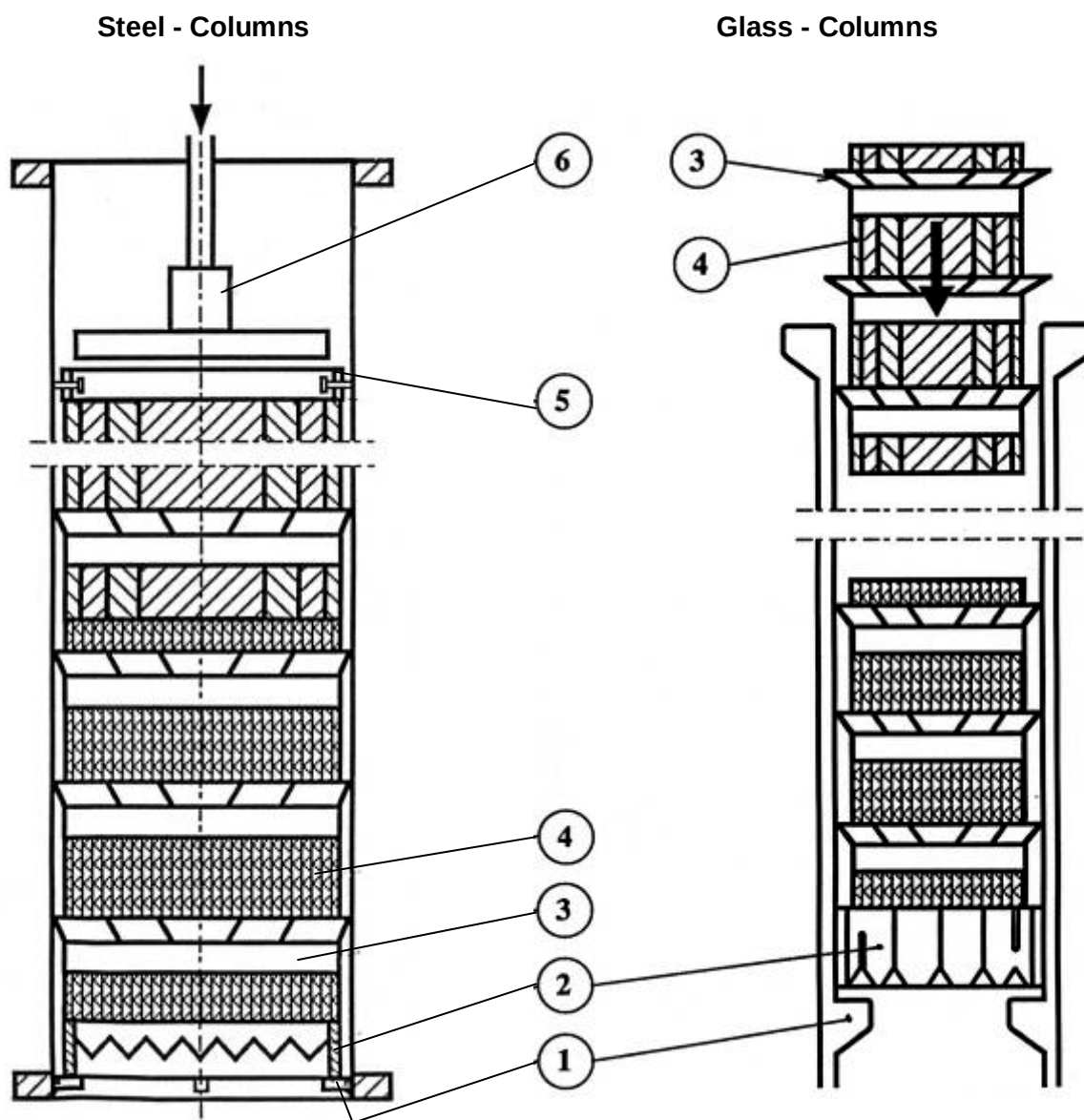
14 Specification for the erection of SULZER pilot columns

Scope: Column inside diameter: 25 - 300 mm

Gap between packing and column wall

Sulzer packings gives best efficiency when there is a small gap between the packings and the column wall.

Therefore, the outer diameter of the packings is a few millimeter less than the inside diameter of the column. In order to prevent vapour and liquid bypass, sealing collars are attached to the packing elements.



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15 Installation instructions for Sulzer pilot columns

1	Support clips / support ring Support clips or rings are welded or fitted inside to column wall.
2	Support grid Minimum height of 25 mm with a free cross section $\geq 80\%$. The provided drop-off plates prevent a premature flooding. This is especially for Packing DX, EX, DXM and DYM.
3	Collar Before the Packing installing, the sealing collars made of metal must be well bent out. When installed the collars will adapt to the column wall. Exceptions are: BX made of plastic with diameters below 100 mm. For this packings the collars i.e. the sealing device is a cord often made of the same material.
4	Installing of packing on site The column has to be positioned vertically. The packings with the bent out collars facing upward have to be orientated correctly and carefully lowered. Successive packings are always placed rotated by 90° to the previous one. Exceptions are: For easier installation Packing ≤ 100 mm can also be installed in horizontal column position.
5	Locating grid For metallic columns with a diameter greater than or equal to 100 mm locating grids can be installed.
6	Liquid Supply The liquid should be fed into the middle of the column. For metallic columns with a diameter ≥ 100 mm, a distributor will improve the efficiency of the packing by providing an equal distribution over the whole cross section.
7	Tolerances The column in the installed position is allowed to deviate by a maximum of 0,3% from the vertical.

Section 8

Storage Instructions

1. Sulzer Chemtech ships its trays, packing, internals, and mixers in open slat wood crates for domestic shipments. Solid slat crates lined with plastic are used for export shipments. Carbon steel trays, packing, and internals can receive a rust-ban protective coating if required by the customer for added protection during transportation to the jobsite. Random packing is shipped in polypropylene super-sacks on wood pallets.
2. Crate size: standard size for Trays & Internals is 12' X 4' X 4'; standard size for Packing is 7' X 7' X 6'; The standard size for Random Packing is 4' X 4' X 4'. Mixers are crated based on the equipment size of each order. All product crates sizes may vary based on equipment size and or weight as determined by manufacturing.
3. The storage area selected should be relatively flat with a smooth base that will support the weight of shipping crates and transportation vehicles. The following storage area surfaces are acceptable: concrete, asphalt, gravel, and dry hard packed soils. If outdoors, the storage area should be free draining.
4. Outdoor storage is acceptable for most storage environments for periods less than six months. Equipment stored outdoors should be covered by protective tarps that cover the top and sides of the storage boxes for the purpose of protecting the equipment from the elements. Tarps should be weighted and secured against wind and rain.
5. Equipment stored outdoors in freezing environments should have wood slats placed under the storage boxes to prevent the boxes from becoming frozen to the storage area surface.
6. The preferred means of long term storage of the equipment crates is in a warehouse or other indoor facility. Indoor storage is recommended for the following environments: seaside locations with salt air; locations with freezing and thawing ice and snow; environments with frequent rain storms and environments with acid rain. Long term storage of equipment made from carbon steel must be indoors.
7. Storage under covered pavilions is accepted for location in hot or arid environments not subject to frequent dew formation or high levels of humidity.
8. Equipment crates should be secure and nailed closed until such time as the equipment is removed from the crate for installation in the vessel.

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