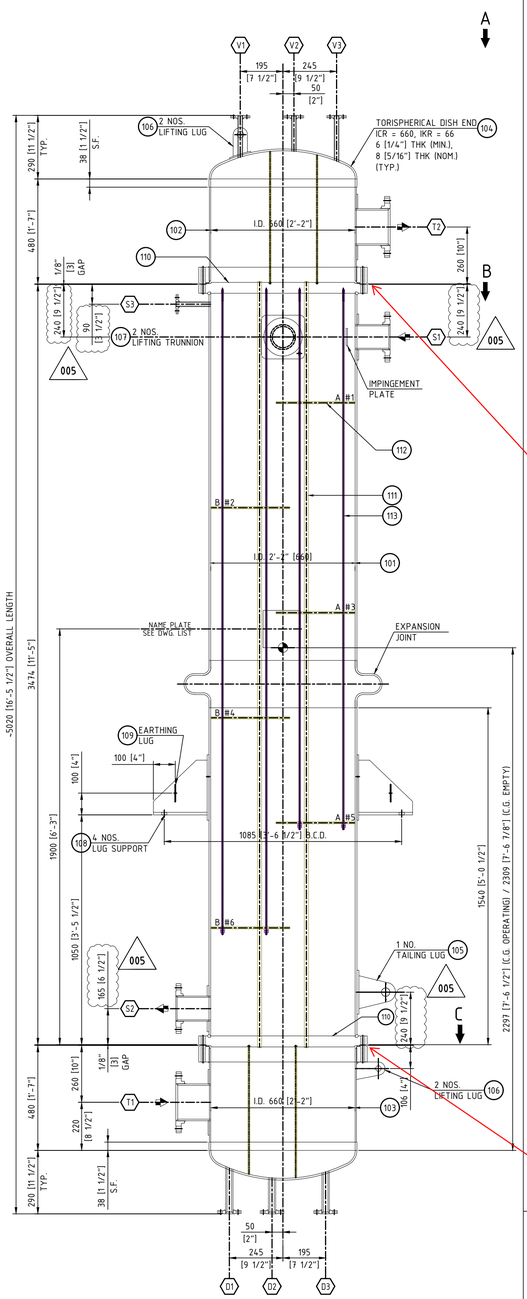
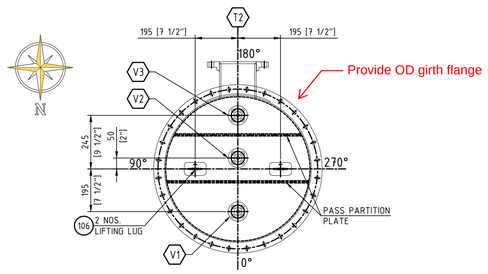
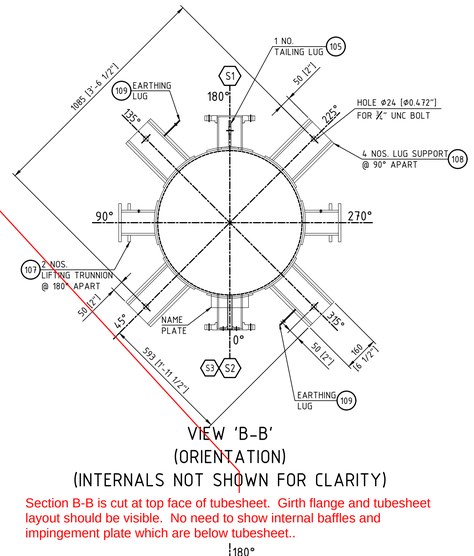
IF IN DOUBT, ASK - DO NOT SCALE !



SECTIONAL ELEVATION
(SECTION VIEW NOT IN ONE PLANE)

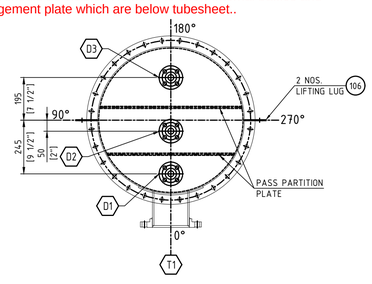


VIEW 'A-A'
(ORIENTATION)



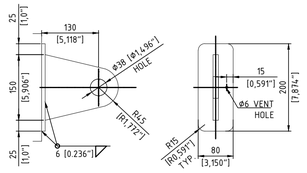
VIEW 'B-B'
(ORIENTATION)
(INTERNALS NOT SHOWN FOR CLARITY)

Section B-B is cut at top face of tubesheet. Girth flange and tubesheet layout should be visible. No need to show internal baffles and impingement plate which are below tubesheet..

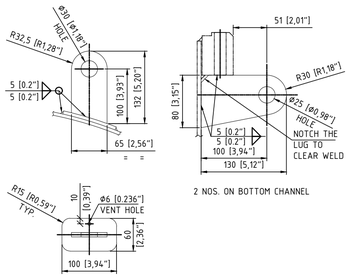


VIEW 'C-C'
(ORIENTATION)
(INTERNALS NOT SHOWN FOR CLARITY)

Section C-C is looks down from flange break. Internal pass partitions are shown. Show nozzles D-1, 2 and 3 with phantom or hidden lines as they are below the bottom channel shell.



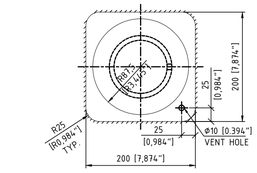
105 DETAIL OF TAILING LUG



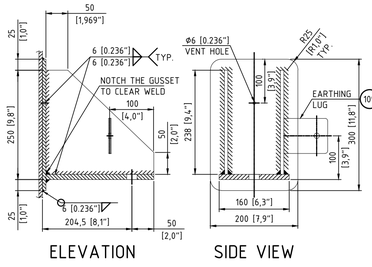
2 NOS. ON TOP DISH END

2 NOS. ON BOTTOM CHANNEL

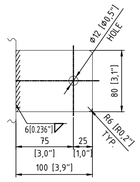
106 DETAIL OF LIFTING LUG



107 DETAIL OF LIFTING TRUNNION



108 DETAIL OF LUG SUPPORT



109 DETAIL OF EARTHING LUG

MECHANICAL DESIGN CONDITION FOR FIXED TUBESHEET EXCHANGERS

CASES	DESCRIPTION	MMT (SHELL) °C [°F]	MMT (TUBE) °C [°F]	Pshell, Bar(g) (psi(g))	Ptube, Bar(g) (psi(g))
NORMAL OPERATION	BASE ON THE PERFORMANCE ACCORD. TO SPECIFIED CONDITIONS OF THIS TEMA-SHEET	175,4[347,7]	171,9[341,4]	8,0[116,03]	6[87,02]
COLD START-UP	TUBESIDE OIL INLET @ 50°C AND SHELL WITH STEAM @ 10 Bar(g)	184,1[363,2]	181[357,8]	8,0[116,03]	6[87,02]
INCIDENT-1:	STEAM VALVE FULLY OPENED, 12 Bar(g) @ SHELL DURING NORMAL OPERATION	191,9[377,4]	187,8[370]	12[174,04]	6[87,02]
INCIDENT-2:	STEAM OPEN TO SHELLSIDE WITH EMPTY TUBES	175,5[347,9]	175[347,9]	8,0[116,03]	0[0,0]
INCIDENT-3:	SHELL SIDE NO STEAM @ ATM, WHILE CIRCULATING OIL THROUGH TUBES	42,6[108,7]	48,1[118,6]	0[0,0]	6[87,02]

APPLICABLE STANDARDS FOR WIND & EARTHQUAKE

WIND DESIGN :- Wind Speed - 101 mph

EARTHQUAKE DESIGN :- S_{DS}= 1.077g, S_{D1} = 0.664g (ASCE 7-16)

APPLICABLE STANDARDS

	DESCRIPTION	EDITION	TITLE
	METALLIC GASKET FOR PIPE FLANGES (LATEST)	2017	ASME B16.20
	STAINLESS STEEL PIPE	2018	ASME B36.19M
	WELDED & SEAMLESS WROUGHT STEEL PIPE (LATEST)	2018	ASME B36.10M
	FORGED FITTINGS (LATEST)	2016	ASME B16.11
	BUTTWELDED FITTINGS (LATEST)	2018	ASME B16.9
	NOZZLE FLANGES UP TO NPS 24 / DN 600	2013	ASME B16.5
	STAINLESS STEEL TUBES	2019	ASME 789

LOADING DATA

SEISMIC MOMENT	N-m	20290
SEISMIC SHEAR	N	15700
WIND MOMENT	N-m	1510
WIND SHEAR	N	2660

GENERAL NOTES :-

1. ALL DIMENSIONS ARE IN In [mm], UNLESS SPECIFIED OTHERWISE.
2. ALL BOLT HOLES SHALL STRADDLE RADIAL CENTER LINES.
3. PROJECTION OF NOZZLES ON SHELL SHALL BE FROM EQUIPMENT C.L. UNLESS SPECIFIED.
4. ALL FULL PENETRATION WELDS (FPW) TO BE CHIPPED BACK TO SOUND METAL ON THE SECOND SIDE & REWELDED, OR FULL PENETRATION WELDS MAY BE ACHIEVED FROM ONE SIDE ONLY USING PROPER QUALIFIED WELDING PROCEDURE (WITH GTAW ROOT PASS)
5. ALL WELDING SURFACES TO BE THOROUGHLY CLEANED OF SCALE, RUST,OIL OR FOREIGN BODIES. BEFORE WELDING.
6. ALL SHARP CORNERS SHALL BE ROUNDED OFF TO A MINIMUM 3mm (1/8 in) RADIUS.
7. ALL REINFORCING PADS SHALL HAVE TWO NUMBER 6 mm. NPT (1/4 in) VENT HOLE, PLACED IN THE LOWEST AREA OF PAD. AFTER COMPLETION OF WELDING, THE PAD SHALL BE SUBJECTED TO DRY AIR AND SOAPY WATER TEST AT 0.1 MPa(g). THESE TEST HOLE SHALL BE FILLED WITH RUST PREVENTATIVE GREASE COMPATIBLE WITH THE BASE MATERIAL PRIOR TO SHIPMENT. DO NOT PLUG THE TEST HOLE.
8. PIPES TO BE USED IN NOZZLE CONSTRUCTION SHALL BE SEAMLESS ONLY, IF FABRICATED [ABOVE NPS 10] THE LONG SEAM SHALL BE 100% RADIOGRAPHED.
9. PRESSURE RELIEF DEVICES SHALL BE PROVIDED BY THE USER & SHALL BE THEIR RESPONSIBILITY.
10. EQUIPMENT TOLERANCES SHALL BE STRINGENT OF CODE(TEMA) AND SPECIFICATION. TOLERANCES ON FILLET LEG LENGTH SHALL BE $^{+3}_{0}$ UNLESS SPECIFIED OTHERWISE TOLERANCE ON ROOT HEIGHT FOR WELD PREPARATION SHALL BE $^{+1.0}_{-0.5}$
11. ALL INTERNAL WELD OF SHELL SIDE SHALL BE GROUND FLUSH TO FACILITATE BUNDLE INSERTION. ALL EXTERNAL WELDS SHALL BE KEPT IN AS-WELDED CONDITION.
12. WATER USED FOR HYDROTEST SHALL HAVE CHLORIDE CONTENT LESS THAN 25 ppm.
13. WELDING TO BE DONE AS PER APPROVED WELDING PROCEDURE AND WELD TEST PLAN.
14. PT SHALL BE CARRIED OUT AFTER CHIP BACK IN CASE OF ACCESSIBLE WELD & AFTER ROOT PASS IN CASE OF INACCESSIBLE WELD FOR CATEGORY A, B, C & D JOINT. PT SHALL ALSO BE CARRIED OUT ON ALL ATTACHMENT WELD WITH MAIN SHELL.
15. MACHINED SURFACES, FLANGE FACES, THREADED SURFACES, AND OTHER FINISHED OR DELICATE PARTS SHALL BE WELL-GREASED AND PROTECTED AGAINST RUSTING AND DAMAGE DURING SHIPMENT.
16. IN ADDITION TO THE NDE REQUIREMENT PER CODE & SPECIFICATION, ATTACHMENT WELD FOR LIFTING LUG, TAILING LUG SHALL BE PT/MT EXAMINED.
17. ALL NOZZLE FLANGES UP TO AND INCLUDING 24" NB SHALL BE AS PER ASME B16.5.
18. ALL PRESSURE RETAINING NUTS SHALL BE OF HEAVY SERIES ONLY.
19. GASKET SEATING SURFACE OF GIRTH FLANGE & NOZZLE FLANGE SHALL HAVE SERRATED FINISH OF 3.2-6.3 µm.
20. ANY OFFSET WITHIN THE ALLOWABLE TOLERANCE PROVIDED IN CODE SHALL BE TAPERED AT A THREE TO ONE TAPER.
21. PAINTING:
    SHELL SIDE INTERNAL : SURFACE PROTECTION AS PER TN0001
    SHELL SIDE EXTERNAL : SURFACE PROTECTION AS PER TN0001
    TUBE SIDE INTERNAL : NONE
    TUBE SIDE EXTERNAL : NONE
    TUBE-TUBESHEET JOINT : NONE

Specify tube-tubesheet joint as rolled, rolled with grooves, rolled with seal weld or strength welded.

It is understood that no painting or prep of tube-tubesheet joint is required.

DESIGN PARAMETERS

CONSTRUCTION CODE / REGULATIONS: ASME SECTION VIII DIV.1, 2019 EDITION + TEMA 10TH EDITION (2019)

ASME CERTIFICATION MARK : YES WITH 'U' DESIGNATOR

NATIONAL BOARD REGISTRATION : YES

TEMA CLASS: C, TEMA TYPE: BEM (V), SIZE 660 x 3500 mm

DESCRIPTION	UNIT	SHELL SIDE	TUBE SIDE
FLUID NAME	-	STEAM	PRODUCT 1 + BE
CAPACITY	m³/Hr[ft³]	0.634 [22.389]	0.723 [25.532]
SPECIFIC GRAVITY	-	0.0046 / 0.8842	0.8846 / 0.8713
DESIGN PRESSURE [INT. / EXT.]	Bar(g) [psi(g)]	12.0 / F.V. (174.04 / F.V.)	12.0 / F.V. (174.04 / F.V.)
MAWP (INTERNAL) / MAWP (EXTERNAL)	Bar(g) [psi(g)]	12.0 / F.V. (174.04 / F.V.)	12.0 / F.V. (174.04 / F.V.)
HYDROSTATIC TEST PRESSURE [AT TOP] [POSITION]	Bar(g) [psi(g)]	16.921 (245.42) [UG99(b)] [VERTICAL]	16.921 (245.42) [UG99(b)] [VERTICAL]
MAX. DESIGN TEMPERATURE [INT. / EXT.]	°C [°F]	220 / 220 [428 / 428]	220 / 220 [428 / 428]
MIN. DESIGN METAL TEMPERATURE	°C [°F]	-10 [14] AT 12 Bar g	-10 [14] AT 12 Bar g
TEST TEMPERATURE [MIN. / MAX.]	°C [°F]	0 / 48 [32 / 120]	0 / 48 [32 / 120]
CORROSION ALLOWANCE [INT. / EXT.]	mm[in]	0 / 0	0 / 0
RADIOGRAPHY / JOINT EFFICIENCY	-	NONE / 0.7	NONE / 0.7 (SEAMLESS HEAD)
PWHT	-	EXEMPTED AS PER UHA-44	EXEMPTED AS PER UHA-44
PWHT	-	EXEMPTED AS PER UHA-32	EXEMPTED AS PER UHA-32
IMPACT TEST	-	EXEMPTED AS PER UHA-51	EXEMPTED AS PER UHA-51
NO. OF PASSES	-	ONE	FIVE
PAINTING	-	NA	NOTE-21
INSULATION THICKNESS / TYPE	mm[in] / -	100 (4.0) / MINERAL WOOL	100 (4.0) / MINERAL WOOL
FIREPROOFING (BY CLIENT)	-	NONE	
APPLICABLE UG-22 LOADING DATA	-	(a), (b), (c), (d), (f), (h), (j)	
HEAT TRANSFER AREA PER SHELL	m²[ft²]	113.9 (GROSS), 111.1 (EFF.) [1226 (GROSS), 1196.4 (EFF.)]	
EMPTY WEIGHT [W]	kg [lb]	~2790 [6150]	
TEST WEIGHT [W]	kg [lb]	~4180 [9215]	
OPERATING WEIGHT [W]	kg [lb]	~4030 [8885]	
MANUFACTURER SERIAL NUMBER	-	--	
INSPECTION BY	-	ASME INSPECTOR	

OPERATING PARAMETERS

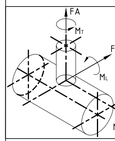
DESCRIPTION	UNIT	SHELL SIDE	TUBE SIDE
OPERATING PRESSURE	Bar(g) [psi(g)]	8.0 / 7.985 (116.03 / 115.81)	6.0 / 5.65 (87.02 / 81.94)
OPERATING TEMPERATURE [IN / OUT]	°C [°F]	175.5 / 175.4 (347.9 / 347.7)	50.0 / 80.0 (122 / 176)

SERVICE RESTRICTIONS

DESCRIPTION	SHELL SIDE	TUBE SIDE
CYCLIC / LETHAL / HYDROGEN SERVICE	NO / NO / NO	NO / NO / NO
SOUR SERVICE / NACE REQUIREMENTS	NO / NO	NO / NO
EXPLOSIVE / FLAMMABLE SERVICE	NO / NO	NO / NO

NOZZLE PARAMETERS

MARK	PIPE SIZE		FLANGE				R.F. PAD		PROJECTION	SERVICE
	NOMINAL DIA.	SCH / THK	CLASS	TYPE	FACE	FINISH Ra µm	O.D. (mm) [In]	THK. (mm) [In]		
S1	NB 4"	SCH 40S	CL 150	SO	RF	3.2-6.3	210 [8 1/4"]	7.93 [5/16"]	490 [1'-7¼"]	STEAM INLET
S2	NB 4"	SCH 40S	CL 150	SO	RF	3.2-6.3	210 [8 1/4"]	7.93 [5/16"]	490 [1'-7¼"]	CONDENSATE OUTLET
T1	NB 6"	SCH 40S	CL 150	SO	RF	3.2-6.3	300 [11 13/16"]	6.35 [1/4"]	490 [1'-7¼"]	PRODUCT 1 + BE INLET
T2	NB 6"	SCH 40S	CL 150	SO	RF	3.2-6.3	300 [11 13/16"]	6.35 [1/4"]	490 [1'-7¼"]	PRODUCT 1 + BE OUTLET
V1 TO V3	NB 1/2"	SCH 40S	CL 150	SO	RF	3.2-6.3	-	-	SEE DRG.	TUBE SIDE VENT
D1 TO D3	NB 1"	SCH 40S	CL 150	SO	RF	3.2-6.3	-	-	SEE DRG.	TUBE SIDE DRAIN
S3	NB 1/2"	SCH 40S	CL 150	SO	RF	3.2-6.3	-	-	490 [1'-7¼"]	SHELL SIDE VENT



PIPING NOZZLE LOADS TABLE

MARK	RADIAL FORCE (FA) [N (lbs)]	CIRC. FORCE (Fc) [N (lbs)]	LONG. FORCE (Fl.) [N (lbs)]	CIRC. MOMENT(Mc) [N-m (ft-lbs)]	LONG. MOMENT(Ml.) [N-m (ft-lbs)]	TORSIONAL MOMENT(Mt) [N-m (ft-lbs)]
S1	2840 [638]	2130 [479]	2840 [638]	680 [502]	1020 [752]	1280 [944]
S2	2840 [638]	2130 [479]	2840 [638]	680 [502]	1020 [752]	1280 [944]
T1	3820 [859]	2860 [643]	3820 [859]	1160 [856]	1740 [1283]	2180 [1608]
T2	3820 [859]	2860 [643]	3820 [859]	1160 [856]	1740 [1283]	2180 [1608]

Provide allowable loads for all nozzles

TOP AND BOTTOM HEAD GASKET TYPE/MATERIAL : GARLOCK 3510 (m = 2 & y = 17.2 MPa (2494.649 psi))
DIMENSION OF TOP AND BOTTOM HEAD GASKET : 701 O.D. x 675 I.D. x 3 THK.

NOZZLE MATERIAL OF CONSTRUCTION

POS. NO.	NOZZLE NECKS	NOZZLE FLANGES
S1	SA-312 GR TP304	SA-182 GR F304
S2	SA-312 GR TP304	SA-182 GR F304
T1	SA-790 (UNS NO. S32205)	SA-182 GR F51 / SA-182 GR F60 (UNS NO. S32205)
T2	SA-790 (UNS NO. S32205)	SA-182 GR F51 / SA-182 GR F60 (UNS NO. S32205)
V1 TO V3	SA-790 (UNS NO. S32205)	SA-182 GR F51 / SA-182 GR F60 (UNS NO. S32205)
D1 TO D3	SA-790 (UNS NO. S32205)	SA-182 GR F51 / SA-182 GR F60 (UNS NO. S32205)
S3	SA-312 GR TP304	SA-182 GR F304

Provide material thicknesses or reference document where information is available.

BILL OF MATERIAL (FOR ONE EQUIPMENT)

PART NO.	PART	QTY	SIZE	MATERIAL	REMARK
113	TIE ROD	7		SS304	
112	BAFFLE PLATE	6		SA-240 TYPE 304	
111	TUBES	544		SA-789 (UNS NO. S32205)	
110	TUBE SHEET	2		SA-240 (UNS NO. S32205)	
109	EARTHING LUG	2	-	SS304	
108	LUG SUPPORT	4	-	SA-240 TYPE 304 / SA-285 GR C	
107	LIFTING TRUNNION	2	-	SA-240 TYPE 304 / SA-285 GR C / SA-106 GR B	
106	LIFTING LUG	4	-	SA-240 (UNS NO. S32205) / SA-285 GR C /	
105	TAILING LUG	1	-	SA-240 TYPE 304 / SA-285 GR C /	
104	CHANNEL DISH	2	-	SA-240 (UNS NO. S32205)	
103	BOTTOM CHANNEL SHELL	1	-		
102	TOP CHANNEL SHELL	1	-		
101	MAIN SHELL	1	-	SA-240 TYPE 304	

REV.	DATE (dd.mm.yyyy)	DESCRIPTION OF MODIFICATION	NBR OF MOD	BY
005	08.11.2021	UPDATED NOZZLES FOR POS.S1, S2 & S3, LIFTING TRUNNION AND TAILING LUG ELEVATION HEIGHT (MARKED 005)		PKV
004	09.09.2021	HOLD REMOVED FOR SUPPORT LUG ELEVATION HEIGHT AND ADDED EXPANSION BELLOW (MARKED 004)		PKV
003	20.07.2021	DRAWING UPDATED AS PER PROCESS COMMENTS (MARKED 003)		PKV
002	05.07.2021	UPDATED ORIENTATION AND HOLD REMOVED FOR ORIENTATION AND DRAWING UPDATED AS PER COMMENTS (MARKED 002)		PKV
001	04.05.2021	DRAWING UPDATED IMPERIAL UNITS TO METRIC AS PER PROCESS COMMENTS (MARKED 001)		PKV

desmet ballestra — DESMET BALLESTRA

DRAWN BY	-	PROCE	GVK
CHECKED BY	-	PROJ.M	JCG
FORMAT	A1	SCALE	1:12
DATE (dd.mm.yyyy)			09.02.2021

ITEM/SECTION NUMBER	W521B.1 (19-X-751)	PROJECT	WORPAR
ITEM/SECTION DESCRIPTION	OIL / STEAM HEAT EXCHANGER	DOCUMENT	VESSEL (ASSY)

Sh=113.9 D=660 Ltub=3500
GENERAL ARRANGEMENT

DOCUMENT NUMBER	REVISION
100176403	005

A1 (594 x 841)

IF IN DOUBT, ASK DO NOT SCALE !

CAD DRWG. DO NOT MODIFY