DESIGN DATA

CODE OF CONSTRUCTION	ASME SEC. VIII DIV.1 2007 Edn. TEMA CLASS–R 9th EDITION, 2007				SHELL	CHANNEL
	UNIT	SHELLSIDE	TUBE SIDE	PWHT	YES	YES
DESIGN PRESSURE (SEE NOTE-32) ⚠1	Kg/Cm²g	102.6/FV	85.4/FV	RADIOGRAPHY	100%	100%
	kPag	10062/FV	8375/FV	JOINT EFFICIENCY	1.0	1.0
DESIGN TEMPERATURE	°C	273	304	INSPECTION BY	AI/EIL	
HYDROTEST PRESSURE (SEE NOTE-33) ⚠1	Kg/Cm²g	⚠2A 133.38	111.02	POSITION	HORIZONTAL	TYPE DEU
	kPag	⚠2A 13080.6	10887.5	DUTY	MM Kcal/hr	37.47x1.1
DIFFERENTIAL DESIGN PRESSURE FOR TUBES/TS.	Kg/Cm²g	27.5		EARTHQUAKE SPECIFICATION		EIL SPEC-6879-9-2554-0145.
	kPag	⚠1 2697		WIND LOAD		IS 875
MIN. HYDRO TEST TEMPERATURE	°C	20	20	ADDITIONAL LOADING AS PER UG-22		NOZZLE LOADS
OPERATING PRESSURE ⚠1	Kg/Cm g	87.7	73.0	CODE STAMPING REQUIRED		YES 'U'
	kPag	8600.5	7159	TOLERANCE	TEMA CLASS R & EIL STD. 7-15-0019 REV.1	
OPERATING TEMPERATURE (IN / OUT)	°C	193.2/227.1	267.9/240			
INSIDE DIAMETER	mm	1475	1518			
No. OF PASSES	Nos.	ONE	TWO			
FLUID CIRCULATED		REACTOR FEED	REACTOR EFFLUENT			
INSULATION	mm	65	75			
CORRN. ALLOWANCE	mm	SEE NOTE–26				
MAWP FULLY CORRODED (AT DESIGN TEMP.) ⚠1	10062 kPag AT 273 °C SHELL SIDE					
	8375 kPag AT 304 °C TUBE SIDE					
MAWP FULLY CORRODED (AT AMBIENT TEMP.) ⚠1	10062 kPag AT 30 °C SHELL SIDE					
	8375 kPag AT 30 °C TUBE SIDE					
MAWP UNCORRODED (AT DESIGN TEMP.) ⚠1	10062 kPag AT 273 °C SHELL SIDE					
	8375 kPag AT 304 °C TUBE SIDE					
MAWP UNCORRODED (AT AMBIENT TEMP.) ⚠1	10062 kPag AT 30 °C SHELL SIDE					
	8375 kPag AT 30 °C TUBE SIDE					
MDMT ⚠1	15 °C AT 10062 kPag SHELL SIDE					
	15 °C AT 8375 kPag TUBE SIDE					

MECHANICAL DATA OF EXCHANGER

EFFECTIVE SURFACE AREA		m^2	582
TOTAL WEIGHT (EMPTY)		Kg.	47692
TUBE BUNDLE WEIGHT		Kg.	19000
HYDRO TEST WEIGHT		Kg.	70412
OPERATING WEIGHT		Kg.	67300
BUNDLE PULLING LOAD		Kg.	38000
No. OF 'U' TUBES	647	PITCH	32
TUBE OD	25	LAYOUT	◇ RT. SQUARE
TUBE THK. (Min.)	3.0		
TUBE EFF. LENGTH	5774 (SHELL SIDE FACE OF T/SHT. TO FULL SUPP. PL. INSIDE FACE)		
IMPACT TESTED PART NO.	SEE NOTE No. 41 ⚠3		

★ @ 30°C

•AS PER GENERAL NOTE–35

NOZZLE SCHEDULE

NOZZ. No.	SERVICE	SIZE DN	SCH	THK	CLASS	TYPE	*FACE	REMARK
			NOZZLE SCHEDULE		ASME B16.5 2003 FLANGES			
T2	CHANNEL OUTLET	400	– ⚠3	25 ⚠3	600#	WN	RF	
T1	CHANNEL INLET	400	– ⚠3	25 ⚠3	900#	WN	RTJ	
S2	SHELL OUTLET	350	FORG.	23.83	900#	WN	RTJ	
S1	SHELL INLET	350	FORG.	23.83	900#	WN	RTJ	

HEAT TREATMENT PROCEDURE :– ⚠3

ITEM DESCRIPTION	HEATING METHOD	TYPE OF HEAT TREATMENT	LOADING TEMP. (°C)	RATE OF HEATING (°C/HOUR)	SOAKING TEMP (°C)	SOAKING TIME	RATE OF COOLING (°C/HOUR)	UNLOADING TEMP (°C)
MAIN SHELL ASSEMBLY	IN CLOSED FURNACE	PWHT	300	55	680–700	3.0 Hours	55	300
MAIN SHELL TO CHANNEL BARREL JOINT	ELECTRICAL RESISTANCE	PWHT	300	55	680–700	3.0 Hours	55	300
CH. BARL. ASSLY.	IN CLOSED FURNACE	PWHT	300	55	680–700	4.5 Hours	55	300
'U'–BEND PORTION+ 300mm TUBE(R1 TO R4)	IN CLOSED FURNACE	SR	300	150	680–700	15 Min.	150	–
TUBE TO T/SHT. JOINT	ELECTRICAL RESISTANCE	PWHT	300	55	680–700	2.0 Hours	55	300

TUBE SIDE ADDITIONAL CONDITIONS :– ⚠1

DEPRESSURIZATION PRESSURE	73.0 Kg/cm²g
DEPRESSURIZATION TEMPERATURE	379 °C
CATALYST REGENERATION PRESSURE	25.0 Kg/cm²g
CATALYST REGENERATION TEMPERATURE	298 °C

Reviewed Trevor 30/12/2009 AI

TEMA INDIA LTD. VADODARA

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REV.	DATE	DESCRIPTION	DRWN	CHKD	APPD
3	30.12.2009	AS BUILT DIMENSIONS ARE SHOWN IN BKT (--) AS MARKED ⚠3 AND OTHER CHANGES AS MARKED ⚠3 THUS.	AHS	VED	GDP
2A	21.02.2009	DRAWING IS REVISED AS PER EIL COMMENTS AS MKD. ⚠2A THUS.	BSB	VDP	GDP
2	08.01.2009	DRAWING IS REVISED AS PER EIL COMMENTS AS MKD. ⚠2 THUS.	BSB	VDP	GDP
1	06.09.2008	DRAWING IS REVISED AS PER EIL COMMENTS AS MKD. ⚠1 THUS.	BSB	VDP	GDP
0	15.04.2008	SUBMITTAL FOR APPROVAL	BSB	VDP	GDP

PROJECT NAME : **DHDT, EURO-IV**

ENGINEERING & MANUFACTURER : ⚠3 **"AS BUILT DRAWING"** TEMA INDIA LTD.

Factory: Achhad Works, Dist: Thane–401 606. & Khardi Works, Silvassa. (Office:–B–907,8501, Tech Park, Opp.Vashi Station, Navi Mumbai–400705)

CONSULTANT : **ENGINEERS INDIA LIMITED**

CLIENT : **CPCL REFINERY III** 302

TITLE : **FIRST REACTOR FEED / EFFLUENT EXCHANGER**

W.O. No. 07-386

EQPT. NO. 211-E-1C

JOB NO.	EIL	6879	P.O. No.	6879/6010/1008/018 DT. 27/02/2008
	TEMA	T/E/071201	PR No.	6879-211-EE-PR-6020/0018 Rev.0 DT. 03/04/2008
SCALE	NTS	DWG. No.	SDB/E/071201	SHT. NO. 1 of 17 / Rev. 1 2 2A 3

ISO A3

GENERAL NOTES :-

1] ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2] ALL BOLT HOLES SHALL STRADDLE THE PRINCIPAL CENTRE LINE.
3] ALL SHARP CORNERS SHALL BE ROUNDED OFF TO MINIMUM RADIUS.
4] IF BACK CHIPPING IS NOT POSSIBLE THEN ROOT RUN SHALL BE DONE BY TIG.
ALL ACCESSABLE WELDS TO BE BACK CHIPPED & WELDED FROM OTHER SIDE.
5] STANDOUTS FOR NOZZLES WELDED ON SHELL & CHANNEL SHALL BE MEASURED FROM THE CENTRE LINE OF THE EXCHANGER.
6] ALL INTERNAL WELDS IN THE SHELL SHALL BE GROUND FLUSH IN ORDER TO INSERT AND REMOVE TUBE BUNDLE. ALSO ALL INTERNAL WELDS SHALL BE GROUND FLUSH TO THE EXTENT OF FACILITATING DRAINING OF COMPLETE EQUIPMENT. ALL OTHER WELD MAY BE LEFT IN THE DESCALED CONDITION ONLY.
7] ALL WELDS SHALL BE D.P. CHECKED OR MAGNETIC PARTICLE (MT) TESTED AFTER BACK CHIPPING.
8] ALL FORGINGS SHALL BE ULTRASONICALLY EXAMINED AS PER ASME Sec. II, SA-388. ACCEPTANCE STANDARD SHALL BE IN ACCORDANCE WITH PARA 3.3.4 OF ASME Sec. VIII Div. 2 CODE. SCANNING SHALL BE 100%.
9] ALL FORGINGS SHALL BE IN NORMALISED AND TEMPERED CONDITION.
10] INSIDE EDGES OF TUBE HOLES IN TUBESHEET SHALL BE FREE OF BURRS TO PREVENT CUTTING OF THE TUBES.
11] ALL FABRICATION,INSPECTION & TESTING REQUIREMENT SHALL BE AS PER PR & APPROVED QAP. PROJECT SPECIFICATION & ASME. CODE
12] SUPPORT PLATE & BAFFLE PLATE DISTANCES ARE GIVEN FROM CENTER TO CENTER.
13] HEMI SPHERICAL HEAD SHALL BE IN SINGLE PIECE CONSTRUCTION
HEMISPHERICAL HEADS SHALL BE SUBJECTED TO DYE PENETRANT TEST (BOTH INSIDE & OUTSIDE) AFTER HEAT TREATMENT.
14] APPROVAL ON WPS AND PQR SHALL BE OBTAINED PRIOR TO FABRICATION.
15] ALL GASKET SHALL BE MADE IN SINGLE PIECE CONSTRUCTION. △2
16] ALL SPIRAL WOUND GASKET FOR SHELL SIDE SHALL BE 6.35 MM THK AISI 321 WITH GRAFOIL FILLER AND 4.5 THK AISI 321 OUTER RING.
17] 'T' DENOTES MATCH MARK FOR ASSEMBLY AND SHALL BE PUNCHED ON ALL MATING PARTS.
18] ALL MATERIALS SHALL BE SUPPLIED WITH MILL TEST CERTIFICATE DULY CERTIFIED BY TPI.
REFER PARA 2.1.2 OF 6-15-0001 REV.3.
19] DELETED. △3
20] THE HEAT EXCHANGER SHALL BE PROVIDED WITH PRESSURE GAUGE TO MONITOR N^2 PRESSURE (0.25 Kg/cm^2) AND 1/2" NON RETURN VALVE AS PER 6-15-0001 REV.3. PARA 9.1.
21] EQPT. SHALL BE DRIED & THOROUGHLY CLEANED BOTH INSIDE AND OUTSIDE AND ALL WATER, DIRT,SAND,WELD METAL,SPATTER,WELD ELECTRODES,STUB & FOREIGN MATERIALS SHALL BE REMOVED.
22] FOR CONSTRUCTIONAL DETAILS AND NOMENCLATURES REFER EIL STANDARDS.
EIL PR NO. 6879-211-EE-MR-6020 REV.B EIL THERMAL DATASHEET 6879-211-05-45-DS-001 REV.2, GENERAL SPEC. 6-15-0001 REV.3, 6-15-0003 REV.2, 6-15-0006 REV.3, 6-15-0021 REV.3, 6-15-91 REV.1, 6-12-0018 REV.2, 6-81-0001 REV.0 & 6-81-009 REV.1 7-15-0001 REV.2, 7-15-0002 REV.2, 7-15-0004 REV.2, 7-15-0007 TO 0009 REV-2, 7-15-0016 REV.2, 7-15-0017 REV.2, 7-15-0018 REV.2, 7-15-0019 REV.2, 7-76-0101 REV.3,
23] ALL OF THE REMOVABLE PARTS SHALL BE STAMPED WITH THE ITEM NUMBER.
24] a) PAINTING (SHOP PRIMER) OF EXCHANGERS SHALL BE AS FOLLOWS. :-
THE EXTERNAL SURFACE SHALL BE PREPARED FOR PAINTING BY BLAST CLEANING TO NEAR WHITE FINISH AS PER SSPC-SP-10 [SA 2 1/2 SWEDISH STANDARD (SIS-05-5900)]. SHOP PRIMER SHALL BE NORGANIC ZINC SILICATE COATING 65-75 MICRONS DFT.
b) GASKET CONTACT SURFACES SHALL BE PROTECTED WITH RUST PREVENTIVE COMPOUND.

25] SPARE PARTS :- MANDATORY SPARES
STUD BOLTS/NUTS :- (ONE SET OF EACH SIZE OF NOZZLE WITH BLIND FLG.)
GASKET :- 400% (EACH NOZZLE WITH BLIND FLG. & GIRTH JOINTS)
GASKET RETAINER :- 100% (DIAPHRAGMS)
PUSH RODS :- 100%
SPARE PARTS :- COMMISSIONING SPARES
GASKET :- 200% (EACH NOZZLE WITH BLIND FLG. & GIRTH JOINTS)
26] CORROSION ALLOWANCE

SHELL, SHELL COVER	3mm
CHANNEL	6mm
TUBE SHEET	9mm

27] ANCHOR BOLT MATERIAL HAVE BEEN DESIGNED CONSIDERING A SHEAR STRESS OF 865 Kgf/cm^2 (SCOPE OF SUPPLY BY OTHERS)
28] ALL BOLTING AND THREADS ON THE BARREL SHALL BE LUBRICATED WITH HIGH TEMPERATURE THREAD LUBRICANT VIZ. Ni-GRAPHITE COMPOUND TO PREVENT SEIZURE.
29] REQUIREMENTS OF ALL PR SPECIFICATION DOCUMENTS SHALL BE COMPLIED WITH UNLESS OTHERWISE AGREED BETWEEN EIL & TEMA.
30] CHANNEL BARREL THREADS AND LOCK RING THREADS SHALL BE 100% DP EXAMINED.
31] THE MINIMUM TUBE WALL THICKNESS AT THE BEND PORTION AS PER TEMA CLAUSE RCB-2.31.
32] THE DIFFERENTIAL DESIGN PRESSURE FOR EXCHANGER = 27.5 Kg/cm^2g.
PERMITED EXTERNAL HYDROTEST PRESSURE FOR TUBES 35.75 Kg/cm^2g AT NEW CONDITION & 35.75 Kg/cm^2g AT OLD CONDITION.
33] HYDRO TEST SHALL BE CARRIED OUT AS FOLLOWS :-
A) PRIOR TO ASSEMBLY OF CHANNEL COVER : FROM SHELL SIDE AT A PRESSURE OF 35.75 Kg/cm^2g.
B) AFTER COMPLETE ASSEMBLY : i) FROM TUBE SIDE AT A PRESSURE OF 35.75 Kg/cm^2g
ii) SIMULTANEOUSLY FROM SHELL SIDE & TUBE SIDE AT A PRESSURE INDICATED IN DESIGN DATA.
CAUTION :- THE DIFFERENTIAL HYDRO TEST PRESSURE BETWEEN SHELL SIDE & TUBE SIDE SHALL NOT BE ALLOWED TO EXCEED MORE THAN 35.75 Kg/cm^2g AT ANY TIME DURING HYDROTEST.
34] SHELL SIDE AND TUBE SIDE WILL BE SUBJECTED TO STEAMING OUT AT 0.5 Kg/cm^2g & 190°C
35] a) WNRTJ NOZZLE FLANGES GASKET FINISH SHALL BE 63-125 AARH.
b) WNRF NOZZLE FLANGES GASKET FINISH SHALL BE 125-250 AARH.
36] GASKET FACE TO BE MACHINED AFTER FINAL HEAT TREATMENT.
37] NO WELDING OR HEATING IS PERMITTED AFTER PWHT OPERATION.
38] ALL FABRICATION TOLERANCES SHOULD BE AS PER TIL-MFG-WI-26 REV.0 PAGE 1 TO 10. UNLESS OTHERWISE SPECIFIED.
39] ALL MATERIAL AND FABRICATION REQUIREMENTS SPECIFIED IN AXEN'S SPECIFICATION IN 42.1 △1 SHALL BE COMPLIED WITH. THIS INCLUDES REQUIREMENTS SPECIFIED FOR CLAD MATERIALS, WELDING CONSUMABLES AND WELDING ETC.
40] TORQUE TABLE (MAX. ALLOWABLE TORQUE)

△2

ITEM No.	kgf.m	lbf.ft.
504	54.54	394.5
505	72.306	523
506	51.331	371.3

41] IMPACT TEST SHALL BE CARRIED OUT FOR 101,102,205, △3 206 AT -18 °C.
PART NO. 114, 115, 116, 117, 119, 138, 139, 201, 202, 203, 204, 213, 214, 215 & 216 AT -18 °C.

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W.O. No. : 07-386
EQPT. NO. : 211-E-1C

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TEMA INDIA LTD. CHHATRAPUR

GENERAL NOTES :-

42] HEMI HEAD NORMALIZED AT 940°C FOR 38 MINUTES, TEMPERING AT 730°C FOR 30 MINUTES COOLING IN STILL AIR.

P.No.	DESCRIPTION	SIZE	MATERIAL SPECIFIED.	QTY	REMARK
	PLATES				
140	BEND PLATE FOR HYDRO	1354°x50x24.61THK.	SA240 Gr.321	1	
139	NOZZLE NECK FOR T2	1198°x490 LG.x25THK.	SA387 Gr.11 CL-2	1	
138	NOZZLE NECK FOR T1	1198°x445 LG.x25THK.	SA387 Gr.11 CL-2	1	
137	SUPPORT GUSSETS	60x60x16THK.	SA387 Gr.11 CL-2	20	
136	SPOOL PIECE FOR T1	1217°x500x19THK	SA240 Gr.321	1	OD406.4xID368.4
135	WARNING PLATE BRACKET	8THK AS PER DETAIL	SA387 Gr.11 CL-2	1	
134	NAME PLATE BRACKET	8THK AS PER DETAIL	SA387 Gr.11 CL-2	1	
133	PL. FOR LIFTING DEVICE	30THK ASPER DETAIL	SA516 Gr.70	1	(32THK) 3
132	PL. FOR LIFTING DEVICE	30THK ASPER DETAIL	SA516 Gr.70	1	(32THK) 3
131	EARTHING CLEAT	100x75x10THK	SA387 Gr.11 CL-2	2	
130	RIB PL. FOR FIXED SADD SUPP.	276x155x20THK	SA387 Gr.11 CL-2	4	
129	RIB PL. FOR FIXED SADD SUPP.	455xx155x20THK	SA387 Gr.11 CL-2	4	
128	WEB PL. FOR FIXED SADD SUPP.	1412x663x20THK	SA387 Gr.11 CL-2	1	
127	WEAR PL. FOR FIXED SADD SUPP.	1860°x350x20THK	SA387 Gr.11 CL-2	1	
126	BASE PL. FOR FIXED SADD. SUPP.	1400x350x30THK	SA387 Gr.11 CL-2	1	
125	RIB PL. FOR SLIDING SADD SUPP.	134x155x20THK	SA387 Gr.11 CL-2	4	
124	RIB PL. FOR SLIDING SADD SUPP.	390x155x20THK	SA387 Gr.11 CL-2	4	
123	WEB PL. FOR SLIDING SADD SUPP.	1670x588x20THK	SA387 Gr.11 CL-2	1	
122	WEAR PL. FOR SLIDING SADD SUPP.	2172°x350x20THK	SA387 Gr.11 CL-2	1	
121	BASE PL. FOR SLIDING SADD. SUPP.	1700x350x30THK	SA387 Gr.11 CL-2	1	
120	GASKET RETAINER	ø1557x20THK	SA240 Gr.321	1+1	
119	INTERNAL SLEEVE	4260°x87Wx32THK 1	SA387 Gr.11 CL-2	1	
118	RETAINING RING FOR T2 2	OD437.7xID413.7x3THK	SA240 Gr.321	1	
117	PARTITION COVER PLATE	30THK AS PER DETAIL 1	SA387 Gr.11 CL-2	1	
116	END PALTE	OD1515x22THK	SA387 Gr.11 CL-2	1	
115	PLATE FOR INTERNAL CYLINDER	4665°x790x30THK 1	SA387 Gr.11 CL-2	1	
114	PASS PARTITION PLATE	1455x790x34THK 1	SA387 Gr.11 CL-2	1	
113	SEALING STRIP	5810x60Wx8THK	SA387 Gr.11 CL-2	2	
112	SEALING STRIP	3666x150Wx8THK	SA387 Gr.11 CL-2	2	
111	SEALING STRIP	4166x150Wx8THK	SA387 Gr.11 CL-2	2	
110	SLIDING STRIP	5810x70Wx20THK	SA387 Gr.11 CL-2	2	
109	SUPPORT PLATE 'C'	16THK AS PER DETAIL	SA387 Gr.11 CL-2	1	
108	PARTIAL SUPPORT PLATE 'S1'	16THK AS PER DETAIL	SA387 Gr.11 CL-2	1	
107	PARTIAL SUPPORT PLATE 'S'	16THK AS PER DETAIL	SA387 Gr.11 CL-2	1	
106	BAFFLE PLATE 'D'	16THK AS PER DETAIL	SA387 Gr.11 CL-2	1	
105	BAFFLE PLATE 'B'	16THK AS PER DETAIL	SA387 Gr.11 CL-2	5	
104	BAFFLE PLATE 'A1'	16THK AS PER DETAIL	SA387 Gr.11 CL-2	1	
103	BAFFLE PLATE 'A'	16THK AS PER DETAIL	SA387 Gr.11 CL-2	4	
102	HEMI HEAD DISHED END	36THK Nom.	SA387 Gr.11 CL-2	1	
101	MAIN SHELL	4816°x5777x58THK.	SA387 Gr.11 CL-2	1	

BILL OF MATERIALS

P.No.	DESCRIPTION	SIZE	MATERIAL SPECIFIED.	QTY	USED 3 MATERIAL
	TUBES				
302	SPACER	OD25x3.0THKxLG. AS PER TABLE	SA213 T11	AS PER TABLE	
301	'U' TUBES	OD25x3.0THK(Min.)xLG. AS PER TABLE	SA213 T11	647 3	
	FORGING				
222	REF. P. No. 139	–	–	–	
221	REF. P. No. 138	–	–	–	
220	PULLING EYE BOLT	M-36 AS PER DETAIL	SA 105	4	
219	PLUG FOR PULLING EYE BOLT	M-36 AS PER DETAIL	SA387 Gr.11 CL-2	4	
218	SEAL RING FOR T2 1	72THK AS PER DETAIL	SA336 F11 CL-2	1	
217	ADDED STEEL (PROPRIETARY)	–	–	1	
216	INNER COMPRESSION RING 1	OD1388xID1324x35THK	SA336 F11 CL-2	1	
215	OUTER COMPRESSION RING	OD1574xID1516x39.6THK	SA336 F11 CL-2	1	
214	INTERNAL FLANGE 1	OD1526.5xID1324x181THK	SA336 F11 CL-2	1	
213	SPLIT RING	OD1552xID1504x38THK	SA387 GR.11 CL-2	1	(SA336 F11 CL.2) 3
212	COMPANION NOZZ. FLG. FOR T2	400DNxSCH.80x600#WNRF	SA182 F11 CL-2	1	
211	COMPANION NOZZ. FLG. FOR T1 1	400DNxSCH.80x900#WNRTJ	SA182 F11 CL-2	1	
210	NOZZLE FLANGE FOR T2	400DNxSCH.80x600#WNRF	SA182 F11 CL-2	1	
209	NOZZLE FLANGE FOR T1	400DNxSCH.80x900#WNRTJ	SA182 F11 CL-2	1	
208	COMPANION NOZZ. FLG. FOR S1 & S2	350DNxSCH.100x900#WNRTJ	SA182 F11 CL-2	2	
207	NOZZLE FLANGE FOR S1 & S2	350DNxSCH.100x900#WNRTJ	SA182 F11 CL-2	2	
206	FORGE NECK FOR S2	OD483.94xID307.94x480LG.	SA336 F11 CL-2	1	
205	FORGE NECK FOR S1	OD483.94xID307.94x480LG.	SA336 F11 CL-2	1	
204	CHANNEL COVER	ø1520.5x216THK	SA336 F11 CL-2	1	
203	THREADED LOCK RING	OD1612.21xID1468x289.81THK	SA336 F11 CL-2	1	
202	CHANNEL BARREL	AS PER DETAIL	SA336 F11 CL-2	1	
201	TUBE SHEET	OD1515x165THK	SA336 F11 CL-2	1	

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TEMA INDIA LTD. ACHHA

3 "AS BUILT DRAWING"

W.O. No. : 07-386

EQPT. NO. : 211-E-1C

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DWG NO. SDB/E/071201

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	P.No.	DESCRIPTION	SIZE	MATERIAL SPECIFIED.	QTY	REMARK
FISTING						
	3					
	701	CAP FOR HYDROTEST	400DN x SCH. 80	SA 234 Gr.WPB	1	
MISCLLANEOUS						
	610	ASME NAME PLATE	175x120x2THK	AISI 304	1	
	609	WARNING PLATE	155x155x2THK	AISI 304	1	
	608	NAME PLATE	150x136x2THK 1	AISI 304	1	
	607	HANDLE FOR PARTITION COVER	ø16x350LG.	SA387 Gr.11 CL-2	2	
	606	SEAL ROD	ø25x4116LG.	SA739 B11	46	
	605	PUSH ROD	ø25x118LG. 1	SA193 Gr.B16	76+76	
	604	PUSH ROD	ø22x275LG. 1	SA193 Gr.B16	92+92	
	603	PUSH ROD	ø25x148LG. 1	SA453 Gr.660B	80+80	
	602	IMPINGEMENT ROD	ø25x666LG.	SA739 B11	27	
	601	TIE ROD	ø12x5838LG.	SA739 B11	22	
FASTENERS						
	512	STUD-2NUTS FOR T2 COMP. FLG.	1½" UN8x290 LG.	SA193 Gr.B16 / SA194 Gr.16	20+4	3
	511	STUD-2NUTS FOR T1 COMP. FLG.	1⅝" UN8x340 LG.	SA193 Gr.B16 / SA194 Gr.16	20+4	3
	510	STUD-2NUTS FOR S1 & S2 COMP. FLG.	1½" UN8x315 LG.	SA193 Gr.B16 / SA194 Gr.16	40+8	3
	509	STUD FOR SEALING & SLIDING STRIP	M-12x38LG.	SA193 Gr.B7	4	
	508	HEX. HD. BOLT FOR LIFTING DEVICE	M-24x68LG.	SA193 Gr.B7	4	
	507	HEX. SOCKET SET SCREW	M-10x25 LG.	SA193 Gr.B8T CL.2	3	
	506	HEX. HD. BOLT (SET SCREW)	1⅛" UN8x89 LG. 1	SA453 Gr 660B	80	
	505	HEX. HD. BOLT (SET SCREW)	1" UNCx82 LG. 1	SA193 Gr B16	92	
	504	HEX. HD. BOLT (SET SCREW)	1⅛" UN8x89 LG. 1	SA193 Gr. B16	76	
	503	NUTS FOR TIE RODS	M-12 STD.	SA194 Gr. 8T	44	
	502	STUD WITH 1NUT,1-FLAT WASHER & 1-LOCK WASHER	M-12x75LG. 1	SA193 Gr.B8T CL.2+ / SA194 Gr.8T	52	
	501	HEX. HD.SCREW WITH LOCKNUT	M-10x50 LG. 1		28	
GASKETS						
	408	GASKET FOR T2 COMP. FLG.	400DNx600#x4.5THK	AISI 304 SPWD	1+4+2	
	407	GASKET FOR T1 COMP. FLG.	400DNx900#ASME RING No.66	AISI 347	1+4+2	HARDNESS 130BHN Max. (OCTAGONAL RING)
	406	GASKET FOR S1 & S2 COMP. FLG.	350DNx900#ASME RING No.62	5 Cr.-1/2Mo	2+8+4	HARDNESS 120BHN Max. (OCTAGONAL RING)
	405	PACKING SEAL FOR T2	12.7SQx3000LG.	FIBER GLASS UIP-329	1+4+2	
	404	GASKET FOR PARTITION PLATE	3THK (AS PER DETAIL)	NON ASBESTOS WITH ARAMIDE FIBRE	1+4+2	
	403	RING GASKET	OD1558xID1538x3THK	SA240 Gr.321	1+4+2	
	402	GASKET 1	OD1515xID1456.8x1.6THK	SA240 Gr.321	1+4+2	
	401	GASKET	OD1507xID1481x6.35THK	AISI 321 SPWD	1+4+2	SEE NOTE-16

BILL OF MATERIALS

3 **"AS BUILT DRAWING"**

W.O. No. : 07-386

EQPT. NO. : 211-E-1C

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SCALE	REV	SHT
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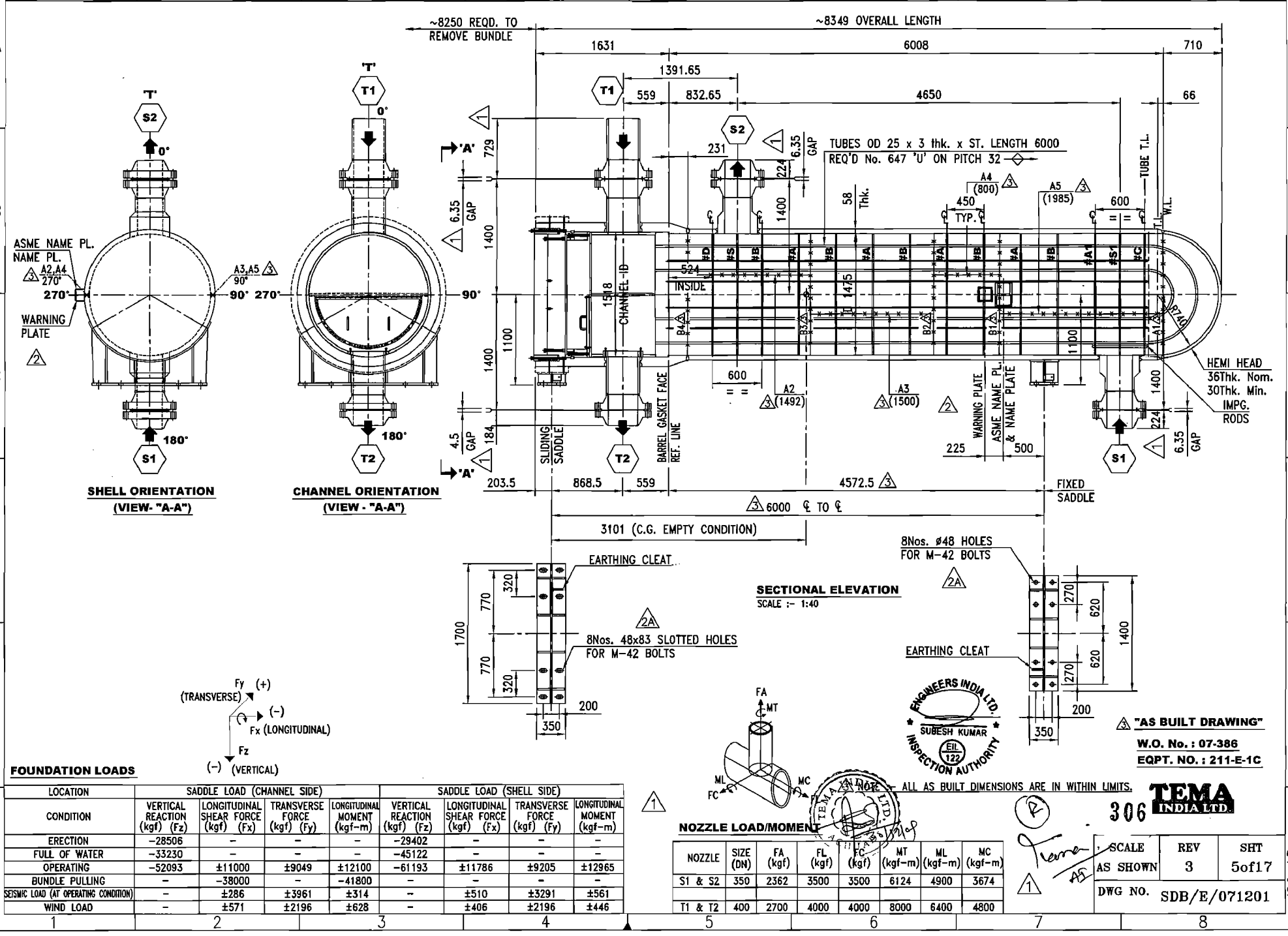

FOUNDATION LOADS

LOCATION	SADDLE LOAD (CHANNEL SIDE)				SADDLE LOAD (SHELL SIDE)			
CONDITION	VERTICAL REACTION (kgf) (Fz)	LONGITUDINAL SHEAR FORCE (kgf) (Fx)	TRANSVERSE FORCE (kgf) (Fy)	LONGITUDINAL MOMENT (kgf-m)	VERTICAL REACTION (kgf) (Fz)	LONGITUDINAL SHEAR FORCE (kgf) (Fx)	TRANSVERSE FORCE (kgf) (Fy)	LONGITUDINAL MOMENT (kgf-m)
ERECTION	-28506	-	-	-	-29402	-	-	-
FULL OF WATER	-33230	-	-	-	-45122	-	-	-
OPERATING	-52093	±11000	±9049	±12100	-61193	±11786	±9205	±12965
BUNDLE PULLING	-	-38000	-	-41800	-	-	-	-
SEISMIC LOAD (AT OPERATING CONDITION)	-	±286	±3961	±314	-	±510	±3291	±561
WIND LOAD	-	±571	±2196	±628	-	±406	±2196	±446

NOZZLE LOAD/MOMENT

NOZZLE	SIZE (DN)	FA (kgf)	FL (kgf)	FC (kgf)	MT (kgf-m)	ML (kgf-m)	MC (kgf-m)
S1 & S2	350	2362	3500	3500	6124	4900	3674
T1 & T2	400	2700	4000	4000	8000	6400	4800

NOTE - ALL AS BUILT DIMENSIONS ARE IN WITHIN LIMITS.

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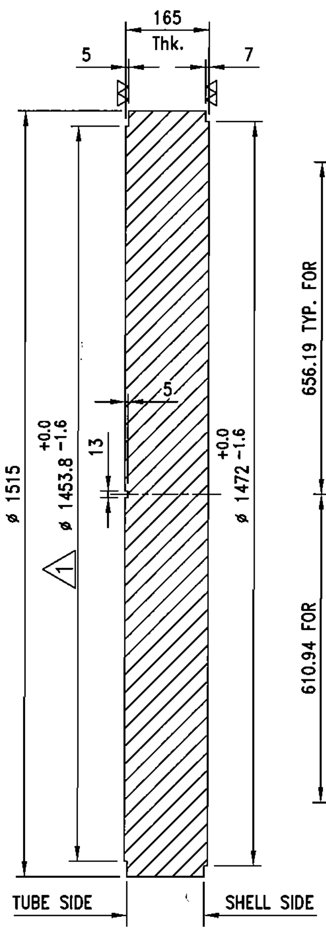
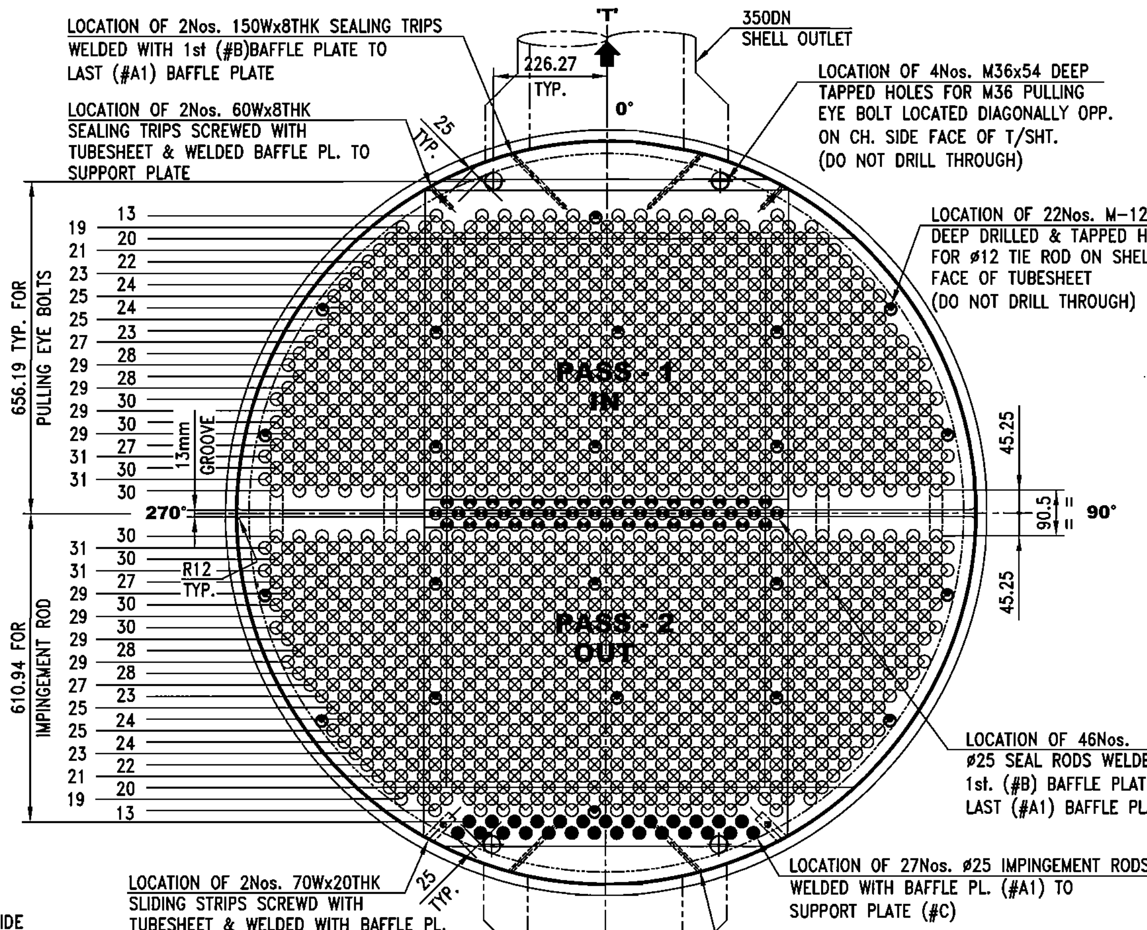
DOME HEIGHT FOR TOP NOZZLE = 136.69
DOME HEIGHT FOR BOTTOM NOZZLE = 91.43





LOCATION OF 2Nos. 150Wx8THK SEALING TRIPS WELDED WITH 1st (#B)BAFFLE PLATE TO LAST (#A1) BAFFLE PLATE

LOCATION OF 2Nos. 60Wx8THK SEALING TRIPS SCREWED WITH TUBESHEET & WELDED BAFFLE PL. TO SUPPORT PLATE

LOCATION OF 4Nos. M36x54 DEEP TAPPED HOLES FOR M36 PULLING EYE BOLT LOCATED DIAGONALLY OPP. ON CH. SIDE FACE OF T/SHT. (DO NOT DRILL THROUGH)

LOCATION OF 22Nos. M−12x18 DEEP DRILLED & TAPPED HOLES FOR ø12 TIE ROD ON SHELL SIDE FACE OF TUBESHEET (DO NOT DRILL THROUGH)

LOCATION OF 46Nos. ø25 SEAL RODS WELDED WITH 1st. (#B) BAFFLE PLATE TO LAST (#A1) BAFFLE PLATE

LOCATION OF 27Nos. ø25 IMPINGEMENT RODS WELDED WITH BAFFLE PL. (#A1) TO SUPPORT PLATE (#C)

LOCATION OF 2Nos. 70Wx20THK SLIDING STRIPS SCREWD WITH TUBESHEET & WELDED WITH BAFFLE PL. TO SUPPORT PLATE (#C)

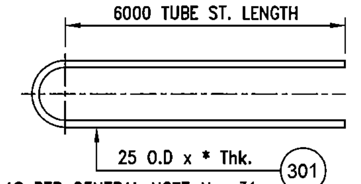
LOCATION OF 2Nos. 150Wx8THK SEALING STRIPS WELDED WITH 1st (#B)BAFFLE PLATE TO LAST (#B) BAFFLE PLATE

13		13	
20	19	20	19
22	21	22	21
24	23	24	23
24	25	24	25
23	25	23	25
28	27	28	27
28	29	28	29
30	29	30	29
30	29	30	29
27	29	27	29
30	31	30	31
30	31	30	31

TUBESHEET LAYOUT
VIEW FROM "A-A"
(REF. SHT. 5 of 17)
SCALE:− 1:10

PASS	1	2
TUBE	647	647

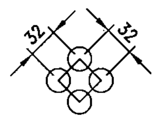
SHELL ID	:	1475
NO. OF TUBE HOLES	:	1294 (647 'U' TUBES)
TUBE HOLE DIAMETER	:	25.25 mm ±0.05
OTL	:	1422.04
PITCH	:	32
LAYOUT	:	45° RT. SQUARE



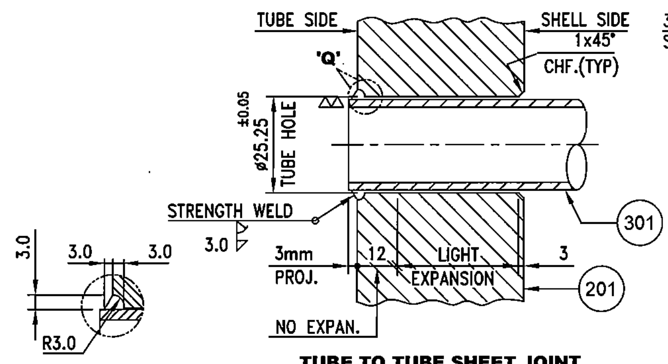
*AS PER GENERAL NOTE No.−31

No.	'R' RADIUS	QTY.	'U' TUBE TOTAL LENGTH
1	R1 = 45.25	30	12142
2	R2 = 67.877	31	12213
3	R3 = 90.505	30	12284
4	R4 = 113.132	31	12355
5	R5 = 135.760	27	12427
6	R6 = 158.387	29	12498
7	R7 = 181.015	30	12569
8	R8 = 203.642	29	12640
9	R9 = 226.270	30	12711
10	R10 = 248.897	29	12782
11	R11 = 271.524	28	12853
12	R12 = 294.152	29	12924
13	R13 = 316.779	28	12995
14	R14 = 339.406	27	13066
15	R15 = 362.034	23	13137
16	R16 = 384.661	25	13208
17	R17 = 407.289	24	13280
18	R18 = 429.916	25	13351
19	R19 = 452.544	24	13422
20	R20 = 475.171	23	13493
21	R21 = 497.798	22	13564
22	R22 = 520.426	21	13635
23	R23 = 543.053	20	13706
24	R24 = 565.681	19	13777
25	R25 = 588.308	13	13848

DETAIL OF "U" TUBES



TUBE PITCH



DETAIL-'Q'

TUBE TO TUBE SHEET JOINT
SCALE:−NTS.

⊕ DENOTE TUBE HOLES
⊕ DENOTE TIEROD HOLES
⊖ DENOTE SEAL RODS
⊕ DENOTE IMPINGEMENT RODS
⊕ DENOTE PULLING EYE BOLTS

△3 **"AS BUILT DRAWING"**
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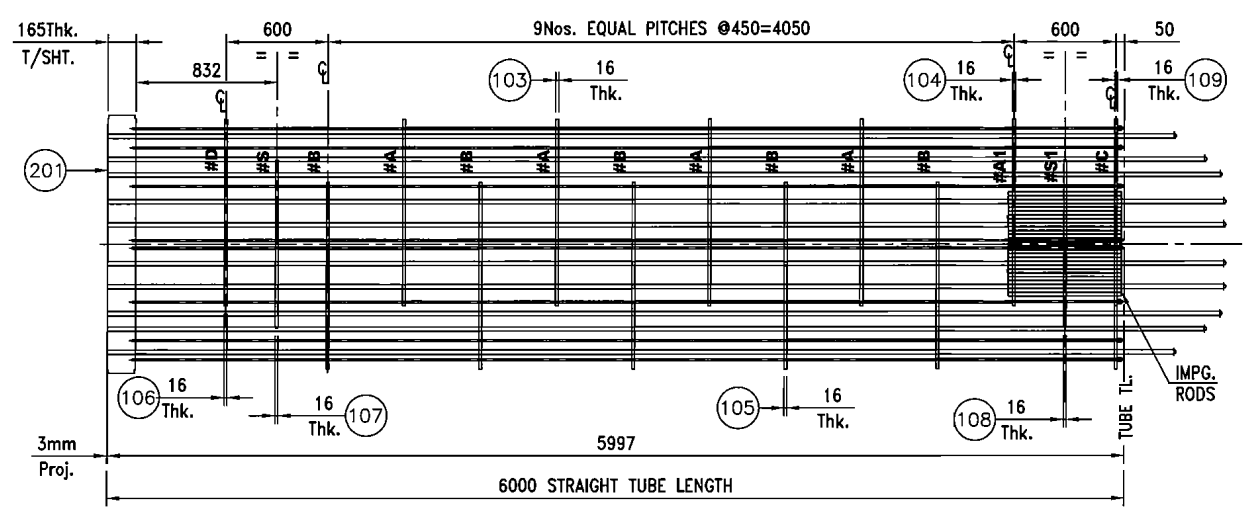
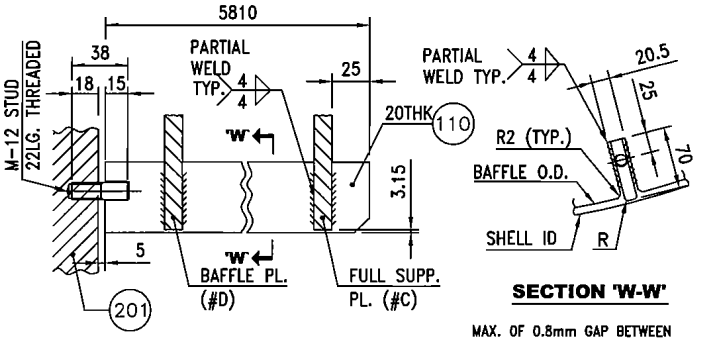


SCALE : 1:30 **TUBE BUNDLE PLAN**



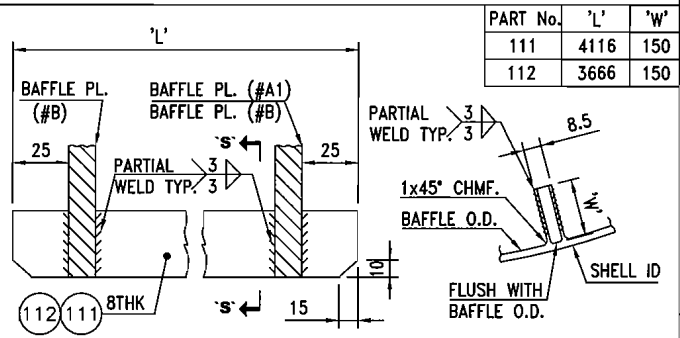
SLIDING STRIP WELD DETAIL

SCALE:- NTS

SECTION 'W-W'

MAX. OF 0.8mm GAP BETWEEN SHELL ID & SLIDING STRIP

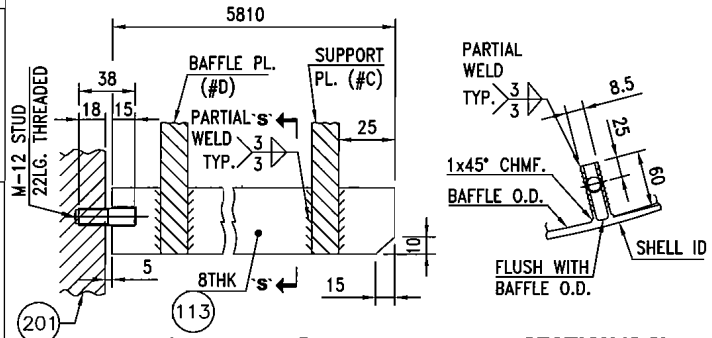
PART No.	'L'	'W'
111	4116	150
112	3666	150



SEALING STRIP WELD DETAIL

SCALE:- NTS

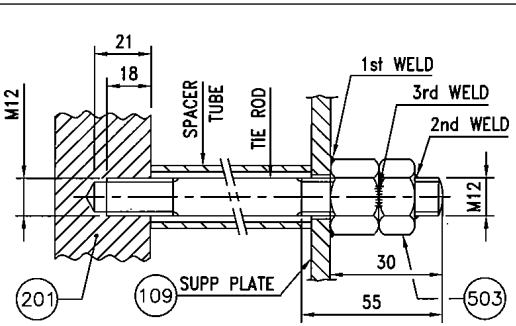
SECTION 'S-S'



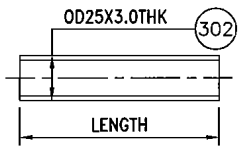
SEALING STRIP WELD DETAIL

SCALE:- NTS

SECTION 'S-S'



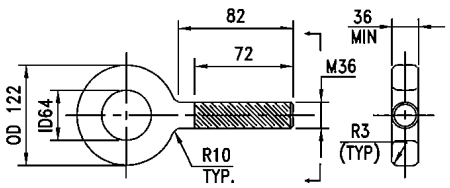
SCALE:- NTS **ARRANGEMENT OF TIE ROD**



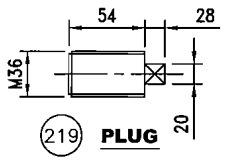
IT.NO	LENGTH	QTY.
302A	524	14
302B	1124	8
302C	284	24
302D	434	126
302E	884	32
302F	584	16
302G	1034	8

SPACER TUBE

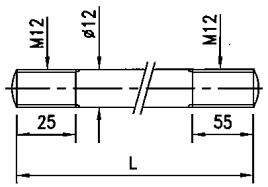
SCALE:- NTS



220 **PULLING EYE BOLT**



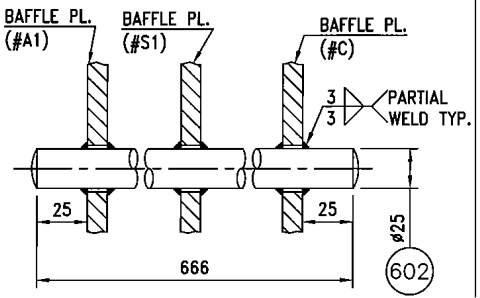
219 **PLUG**



IT NO	LENGTH(L)	QTY.
601	5838	22

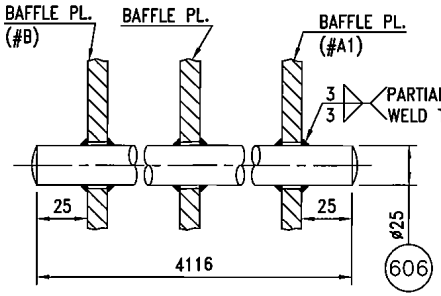
601 **TIE ROD**

SCALE:- NTS



IMPINGEMENT ROD WELD DETAIL

SCALE:- NTS



SEAL ROD WELD DETAIL

SCALE:- NTS

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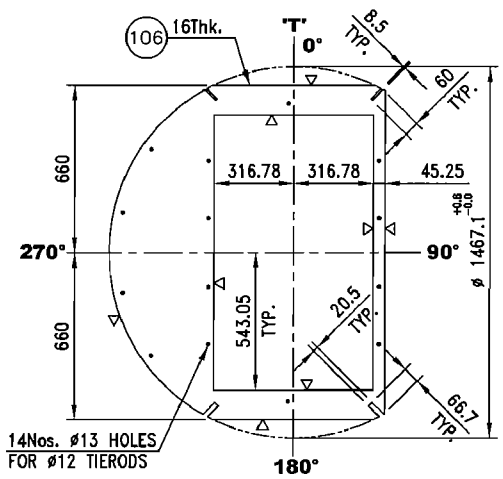
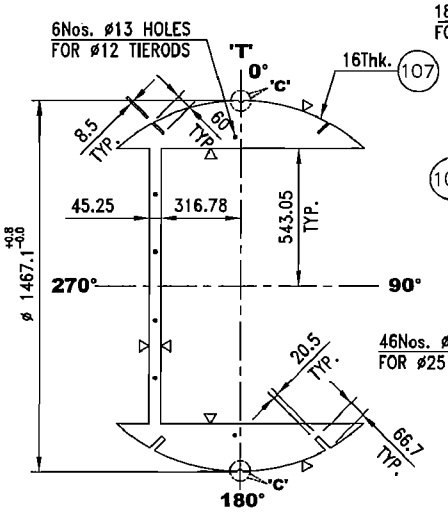
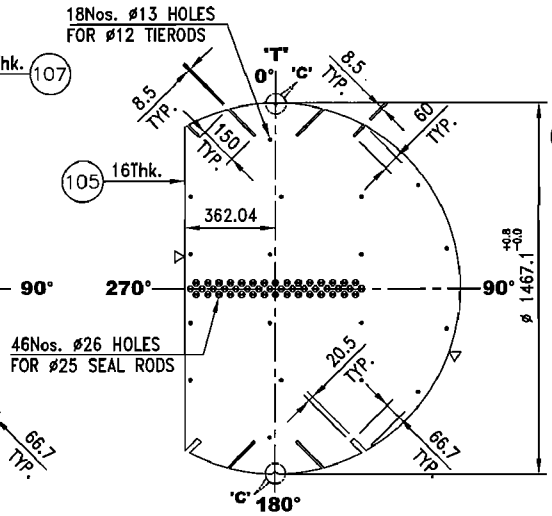


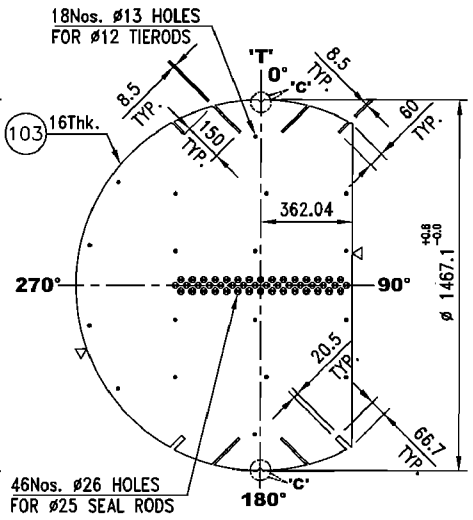
DETAIL OF BAFFLE PLATE
TYPE "D" SCALE : 1:20



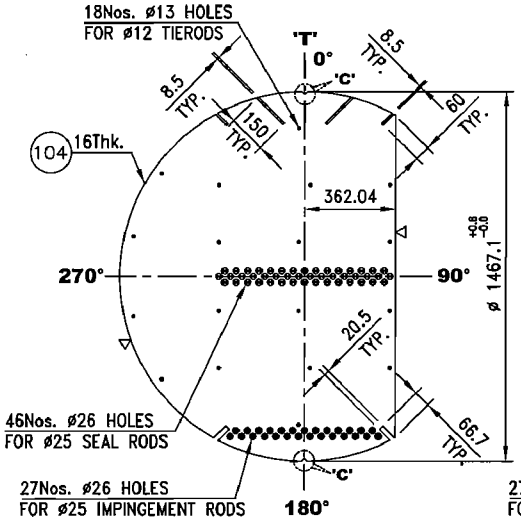
DETAIL OF BAFFLE PLATE
TYPE "S" SCALE : 1:20



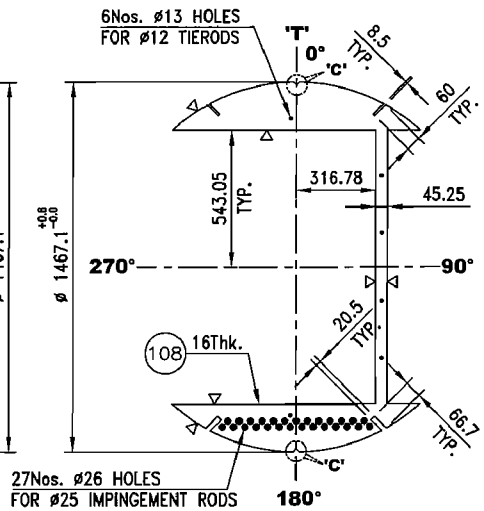
DETAIL OF BAFFLE PLATE
TYPE "B" SCALE : 1:20



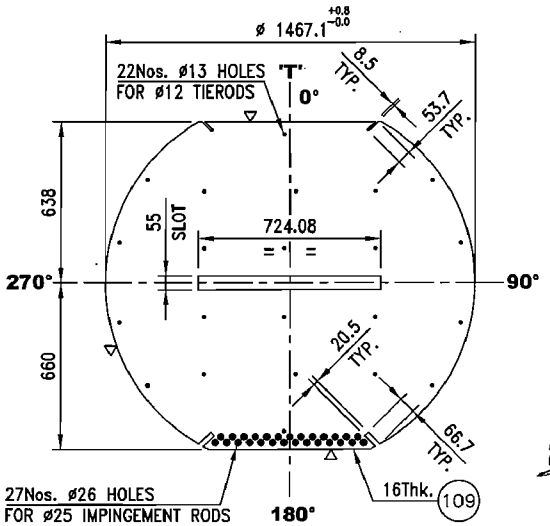
DETAIL OF BAFFLE PLATE
TYPE "A" SCALE : 1:20



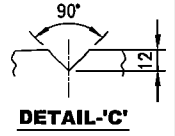
DETAIL OF BAFFLE PLATE
TYPE "A1" SCALE : 1:20



DETAIL OF BAFFLE PLATE
TYPE "S1" SCALE : 1:20



DETAIL OF BAFFLE PLATE
TYPE "C" SCALE : 1:20



DETAIL-'C'

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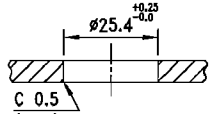
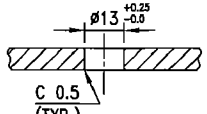
NOTES :-

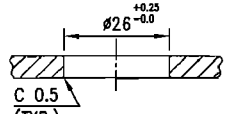
1) TUBE HOLE ø25.4 +0.25 −0.00 TO BE DRILLED AS PER T/SHT. LAYOUT IN THE BAFFLE & SUPP. PLATES.
2) SEALING & SLIDING STRIPS LOCATION AS PER T/SHT. LAYOUT.
3) TIEROD & IMPINGEMENT ROD LOCATION AS PER T/SHT. LAYOUT.
4) SEAL ROD LOCATION AS PER T/SHT. LAYOUT.



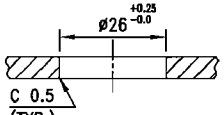
TYP. DETAIL FOR TUBE HOLE



TYP. DETAIL FOR FOR TIEROD HOLE



TYP. DETAIL FOR IMPG. ROD HOLE



TYP. DETAIL FOR SEAL ROD HOLE

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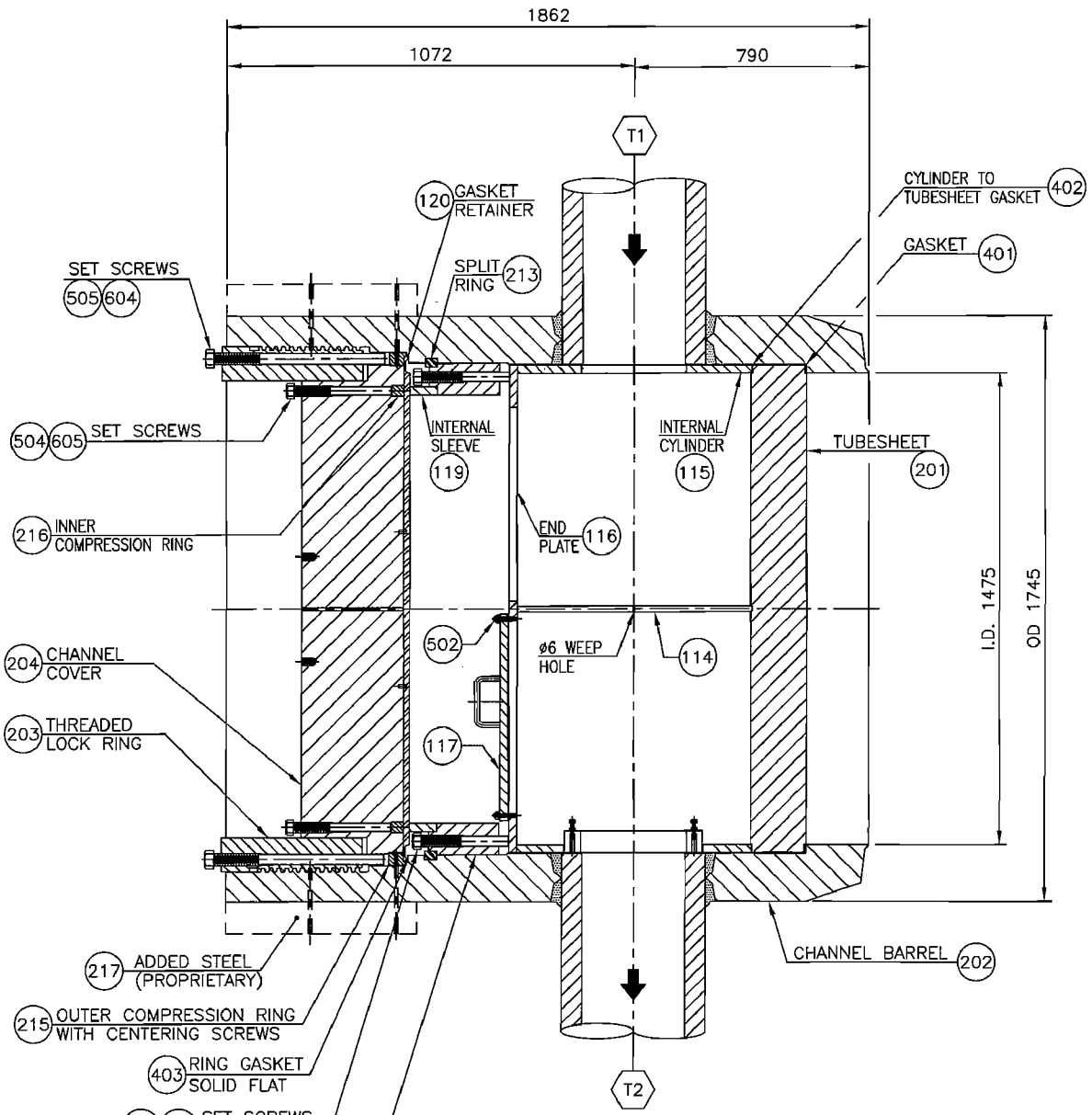
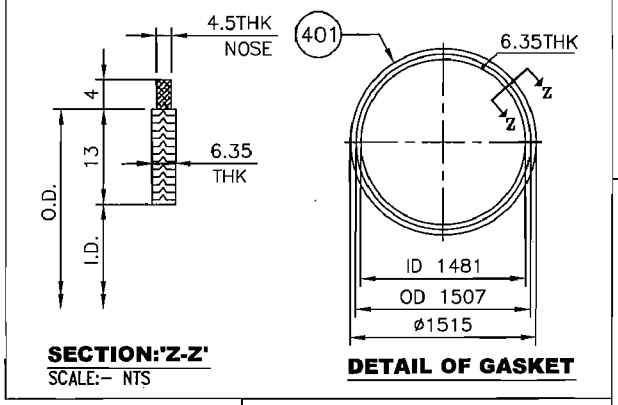
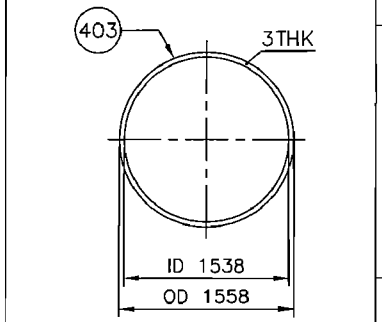


CHANNEL CLOSURE ASSEMBLY
SCALE:- NTS



SECTION:'Z-Z'
SCALE:- NTS

DETAIL OF GASKET



DETAIL OF GASKET
SCALE:- NTS

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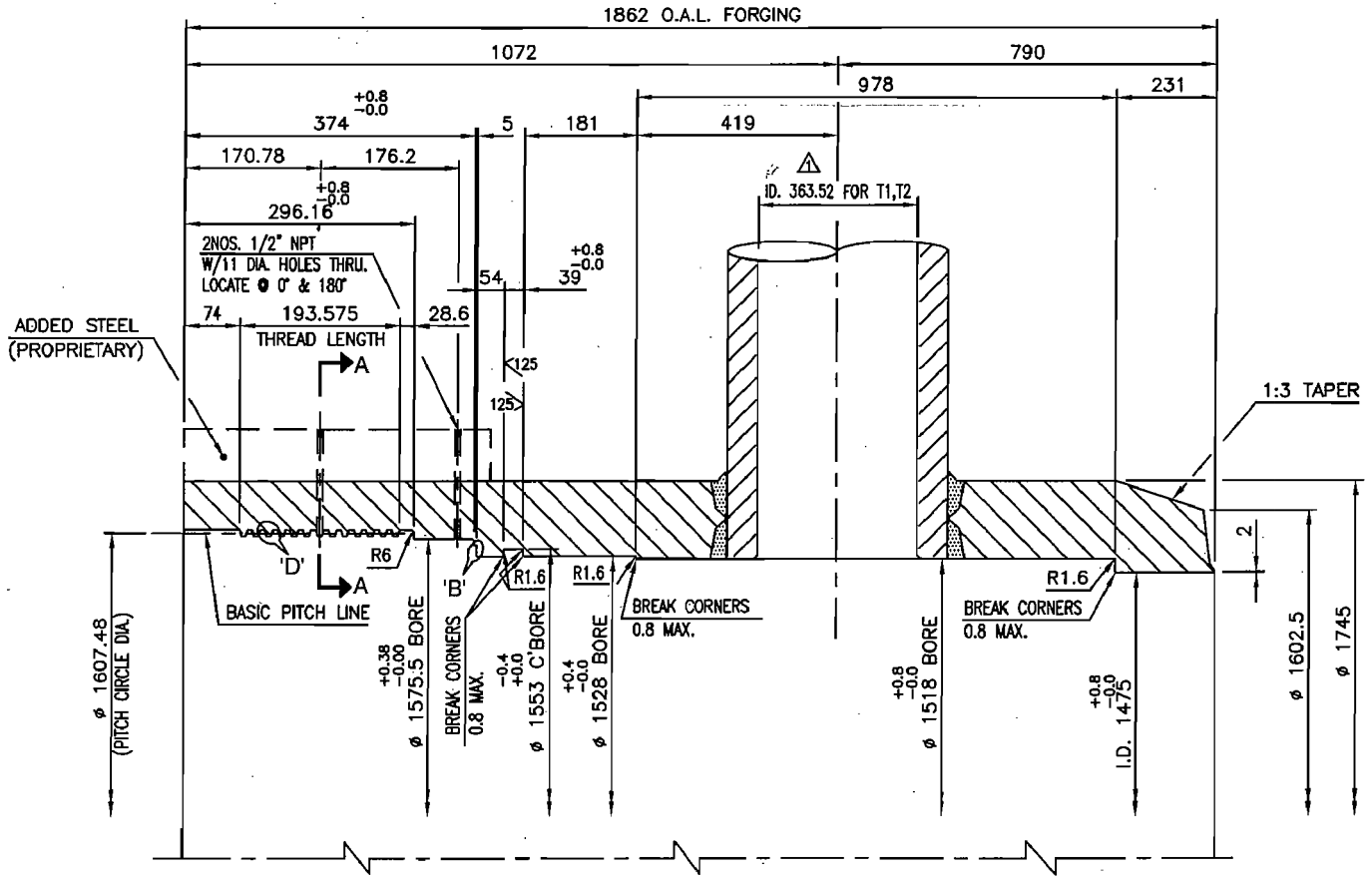
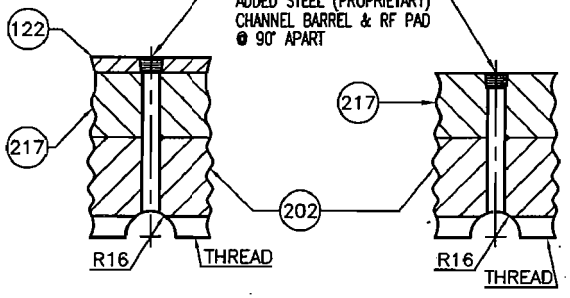
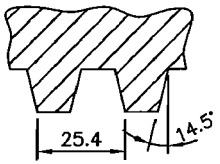


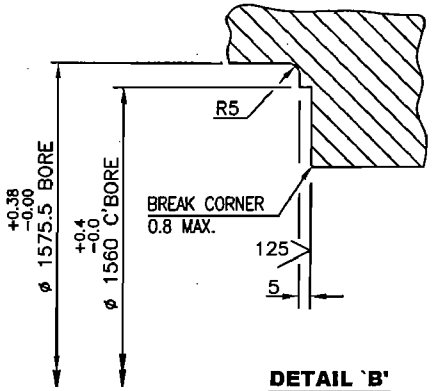
DETAIL OF CHANNEL BARREL
SCALE:– NTS



SECTION `A'-`A'
TYPICAL GREASE GROOVE 4– PLACES 90° APART
SCALE:–NTS.



DETAIL `D' SCALE:– NTS
1 TPI 29° ACME CLASS 2G
STD. THDS.AS PER ASME B1.5
CHANNEL BARREL THREAD DETAIL
125 FINISH OR BETTER ALL OVER



DETAIL `B'
SCALE:– NTS

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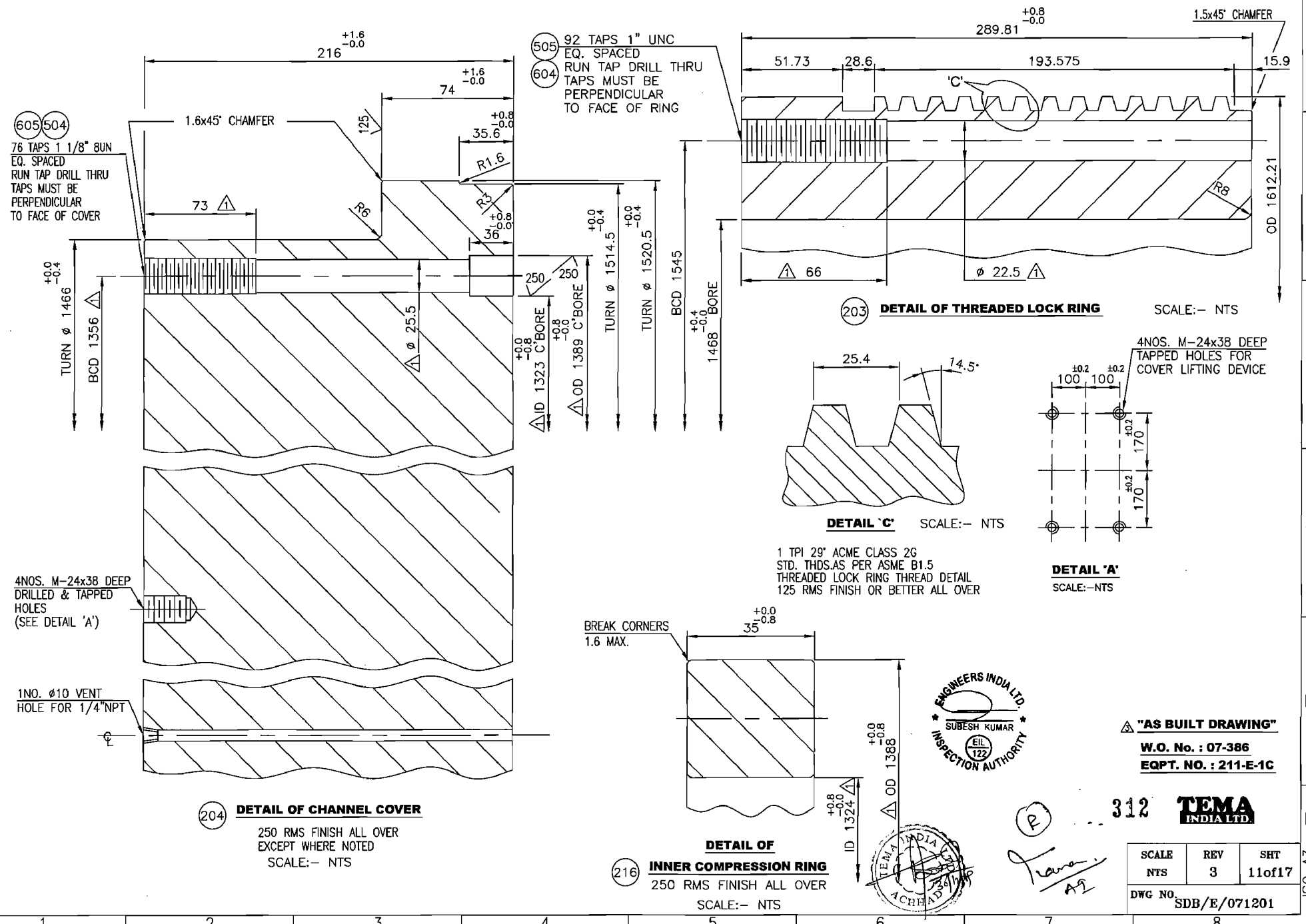
605 504
76 TAPS 1 1/8" 8UN
EQ. SPACED
RUN TAP DRILL THRU
TAPS MUST BE
PERPENDICULAR
TO FACE OF COVER
505
92 TAPS 1" UNC
EQ. SPACED
604
RUN TAP DRILL THRU
TAPS MUST BE
PERPENDICULAR
TO FACE OF RING
1.6x45° CHAMFER
1.5x45° CHAMFER
'C'
4NOS. M-24x38 DEEP
DRILLED & TAPPED
HOLES
(SEE DETAIL 'A')
4NOS. M-24x38 DEEP
TAPPED HOLES FOR
COVER LIFTING DEVICE
1NO. ø10 VENT
HOLE FOR 1/4"NPT
BREAK CORNERS
1.6 MAX.
TURN ø 1466
BCD 1356
ø 25.5
ID 1323 C'BORE
OD 1389 C'BORE
TURN ø 1514.5
TURN ø 1520.5
BCD 1545
1468 BORE
OD 1612.21
ID 1324
OD 1388
R1.6
R3
R6
R8
DETAIL 'C'
SCALE:- NTS
DETAIL 'A'
SCALE:-NTS
1 TPI 29° ACME CLASS 2G
STD. THDS.AS PER ASME B1.5
THREADED LOCK RING THREAD DETAIL
125 RMS FINISH OR BETTER ALL OVER
204 DETAIL OF CHANNEL COVER
250 RMS FINISH ALL OVER
EXCEPT WHERE NOTED
SCALE:- NTS
203 DETAIL OF THREADED LOCK RING
SCALE:- NTS
216 DETAIL OF INNER COMPRESSION RING
250 RMS FINISH ALL OVER
SCALE:- NTS
ENGINEERS INDIA LTD.
SUBESH KUMAR
EIL 122
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W.O. No. : 07-386
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TEMA INDIA LTD.
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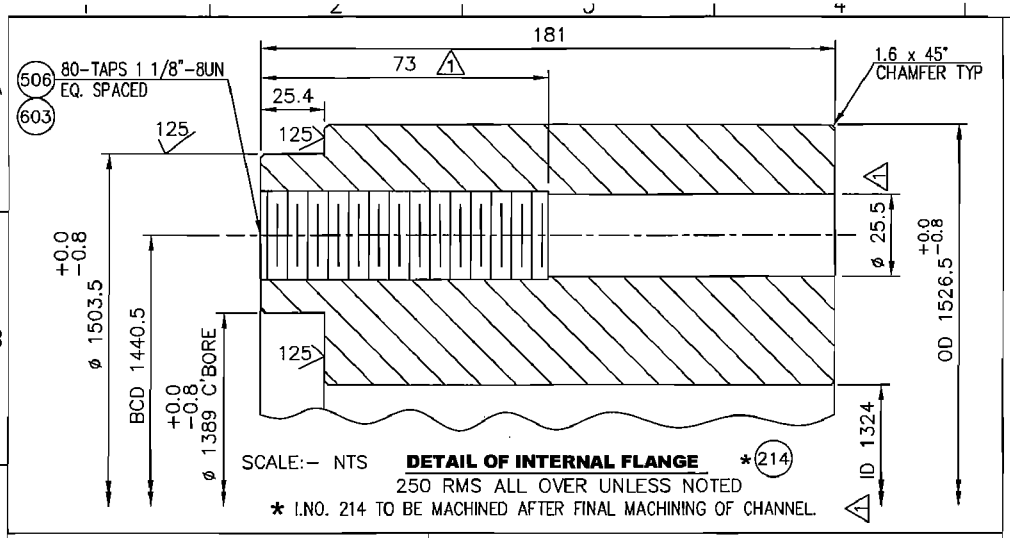
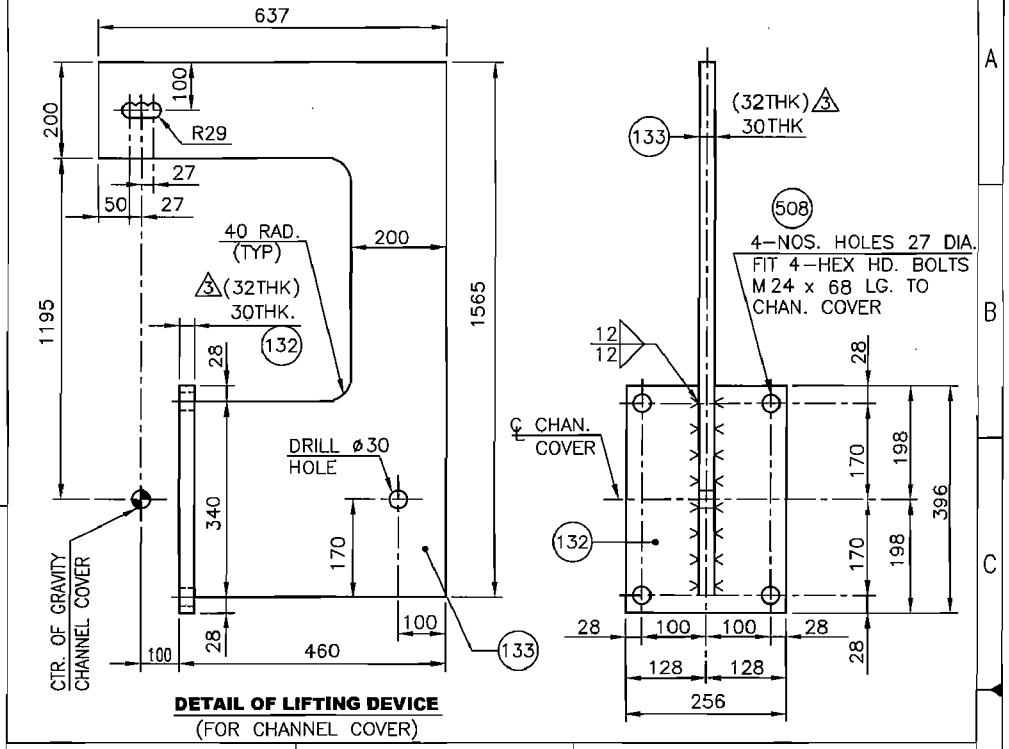
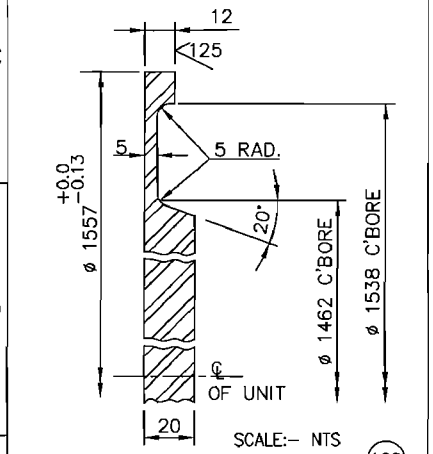
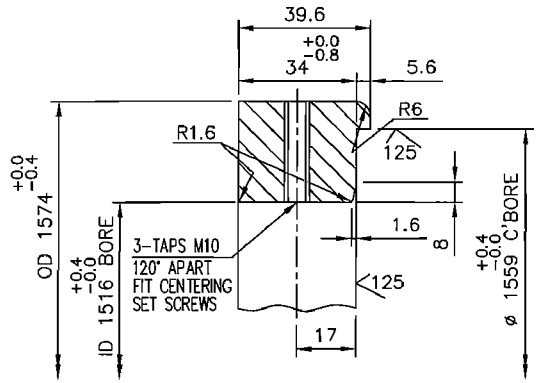
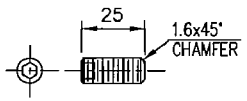




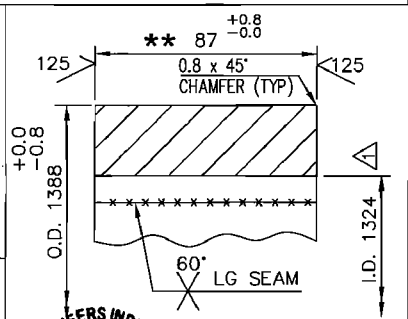


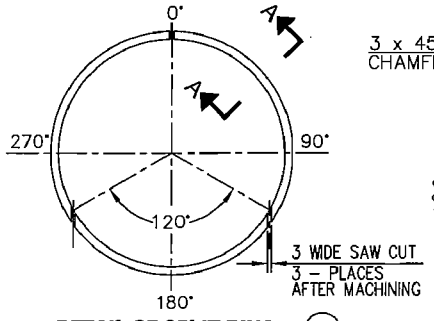


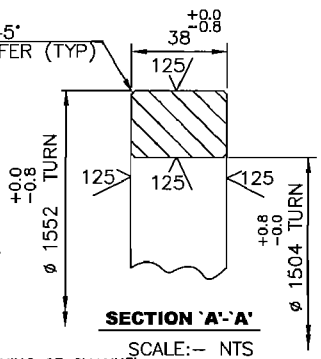


**

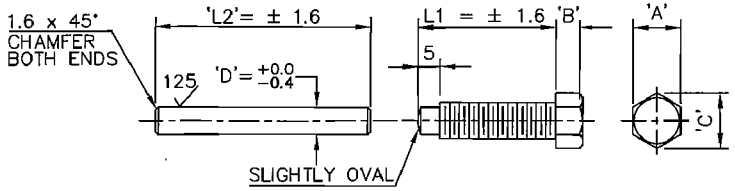
IMP :- THIS DIMENSION TO BE CHECKED AFTER ASSEMBLY OF TUBE BUNDLE & OTHER INTERNALS PRIOR TO M/CING OF PART NO.119 (PART NO.119 SHALL BE FLUSH WITH PART NO.120 WITHIN $^{+0}_{-0.8}$)







* I.NO. 213 TO BE MACHINED AFTER FINAL MACHINING OF CHANNEL.



I. NO.	MARK NO.	SIZE	Q'TY	`L1'	`B'	`A'	`D'	`L2'	`C'
504	HEX. HD. BOLT	1⅛"-8UN	76	89	21.4	38.1	–	–	43.99
505	HEX. HD. BOLT	1"-UNC	92 (1)	82	19.05	33.35	–	–	38.51
506	HEX. HD. BOLT	1⅛"-8UN	80	89	21.4	38.1	–	–	43.99
603	PUSH RODS	–	80	–	–	–	25	148	–
604	PUSH RODS	–	92	–	–	–	22	275	–
605	PUSH RODS	–	76	–	–	–	25	148	–

DETAIL OF SET SCREWS & PUSH RODS

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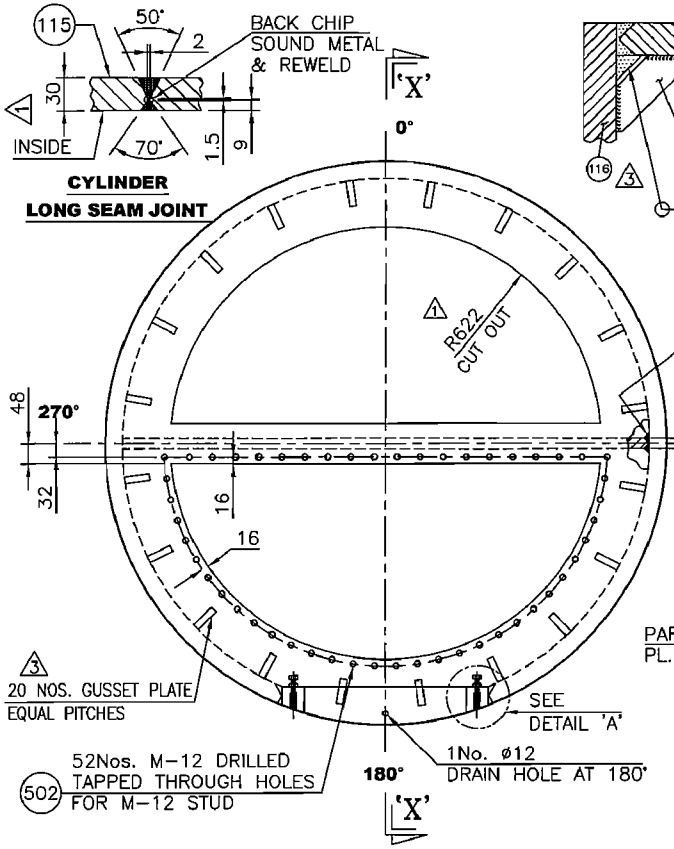
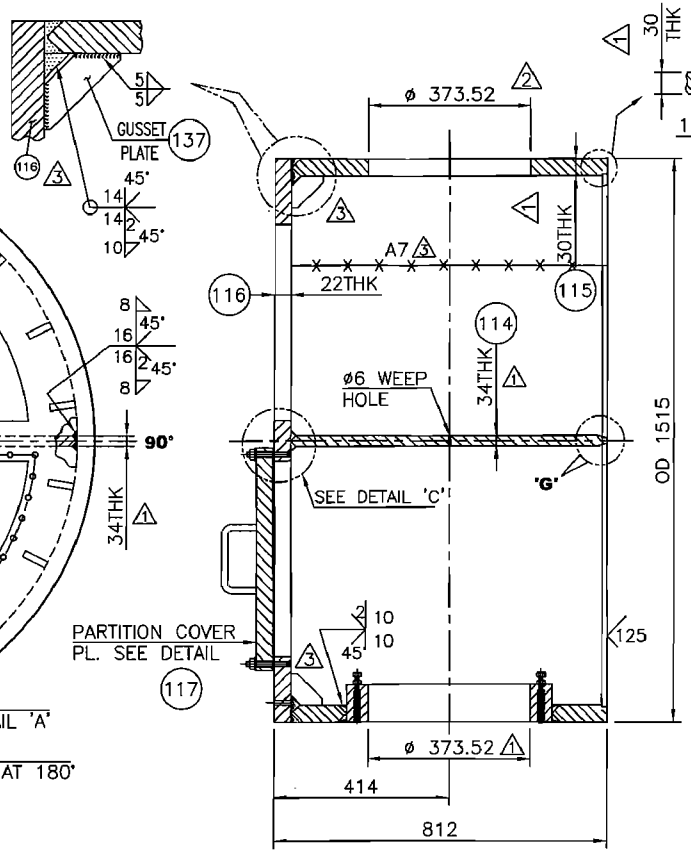
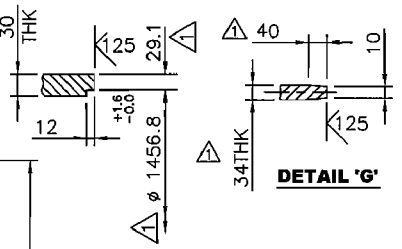
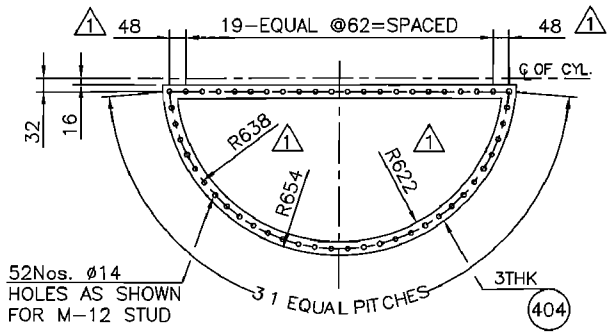
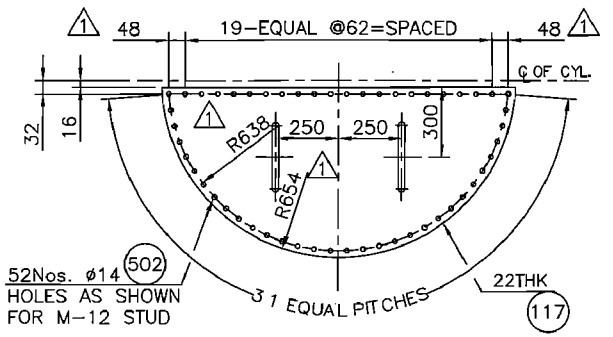


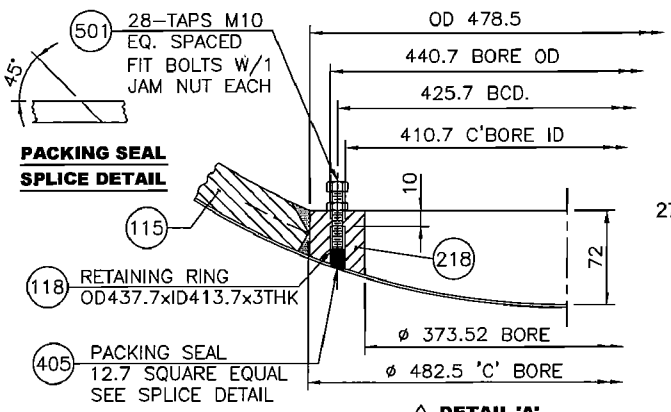


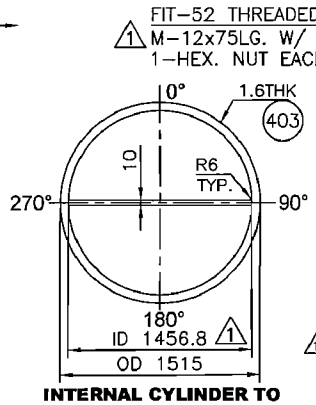
OVERALL MACHINING AFTER ASSEMBLY

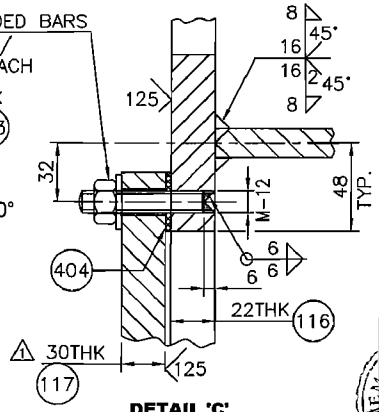


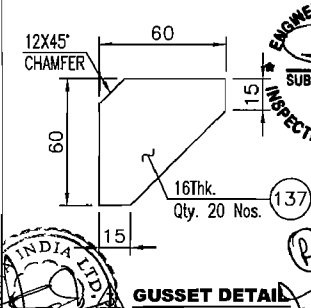












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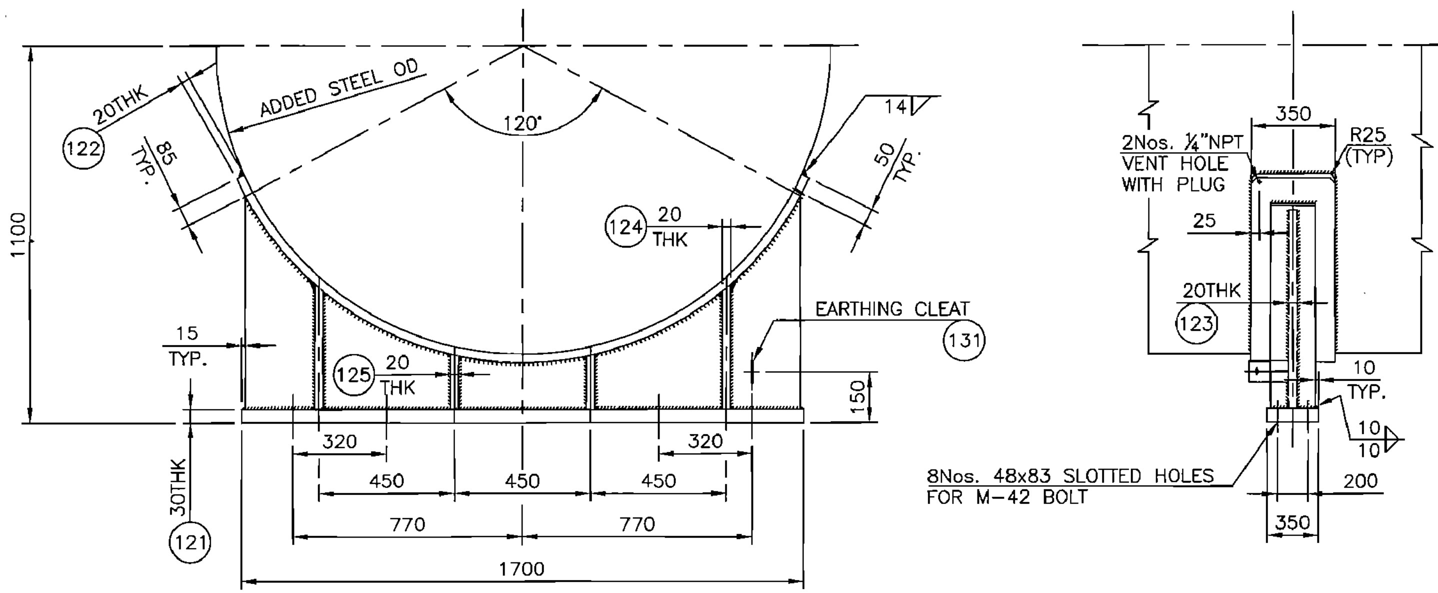
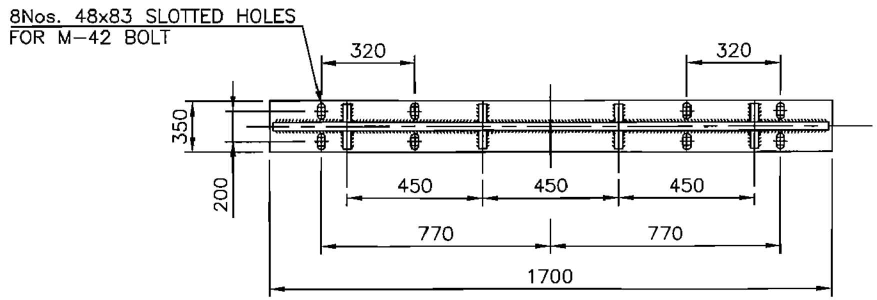
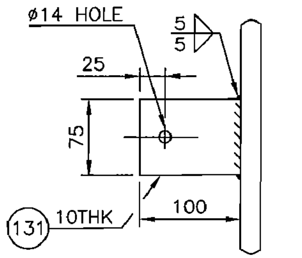


DETAIL OF SLIDING SADDLE SUPPORT FOR CHANNEL SIDE

NOTE :– ALL FILLET ARE 12mm





DETAIL OF EARTHING CLEAT

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"AS BUILT DRAWING" (3)

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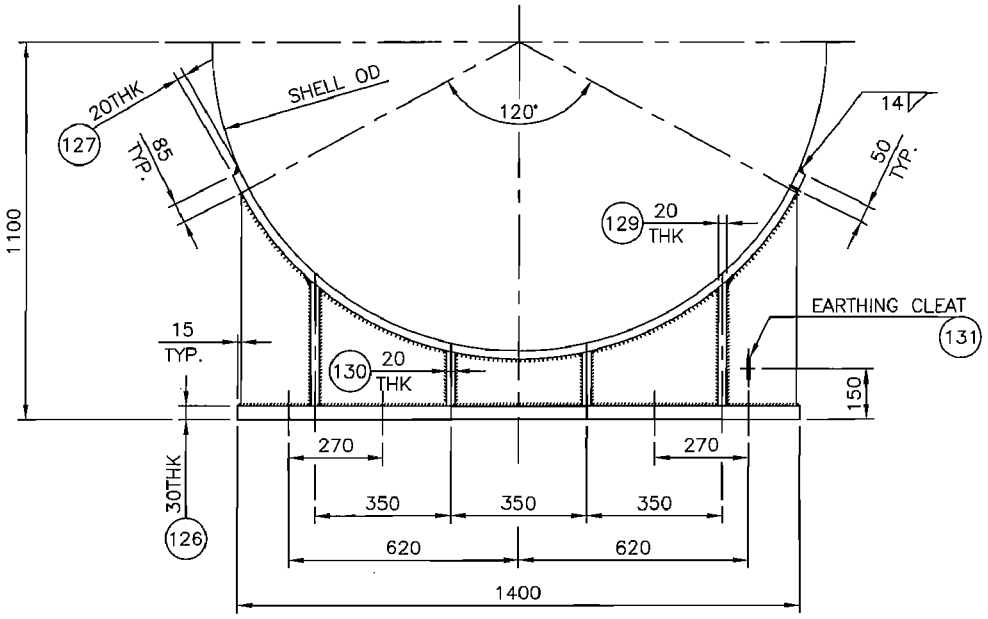
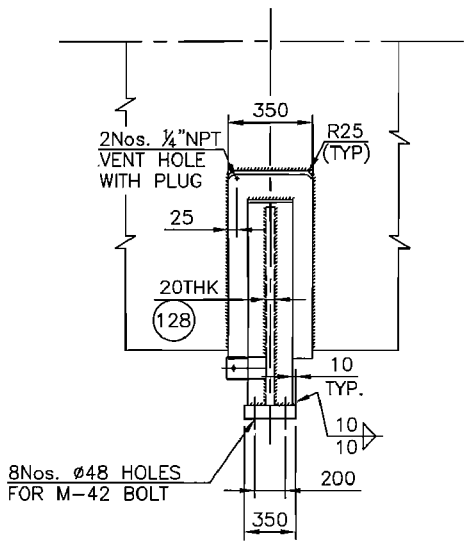
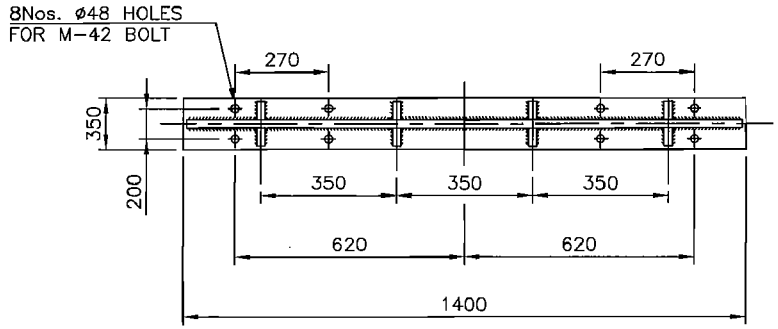
ISO A3

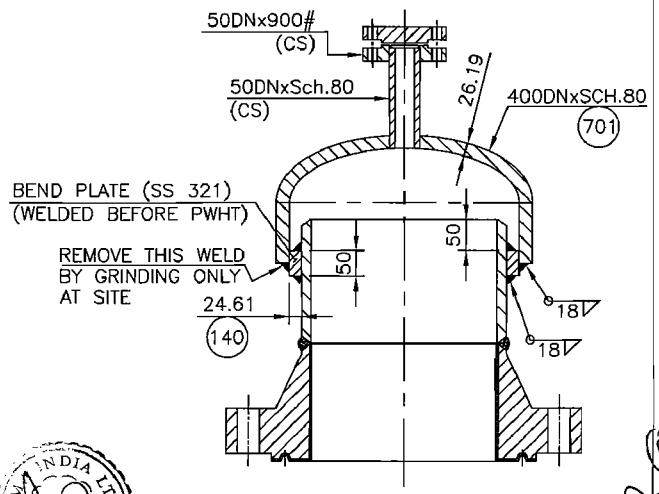




DETAIL OF FIXED SADDLE SUPPORT FOR SHELL SIDE

NOTE :- ALL FILLET ARE 12mm





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△3 **"AS BUILT DRAWING"**

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△3 **HYDROTEST ARRANGEMENT DETAIL**

NOZZLE T1 (SIZE (16"))

SCALE	REV	SHT
NTS	3	15of17

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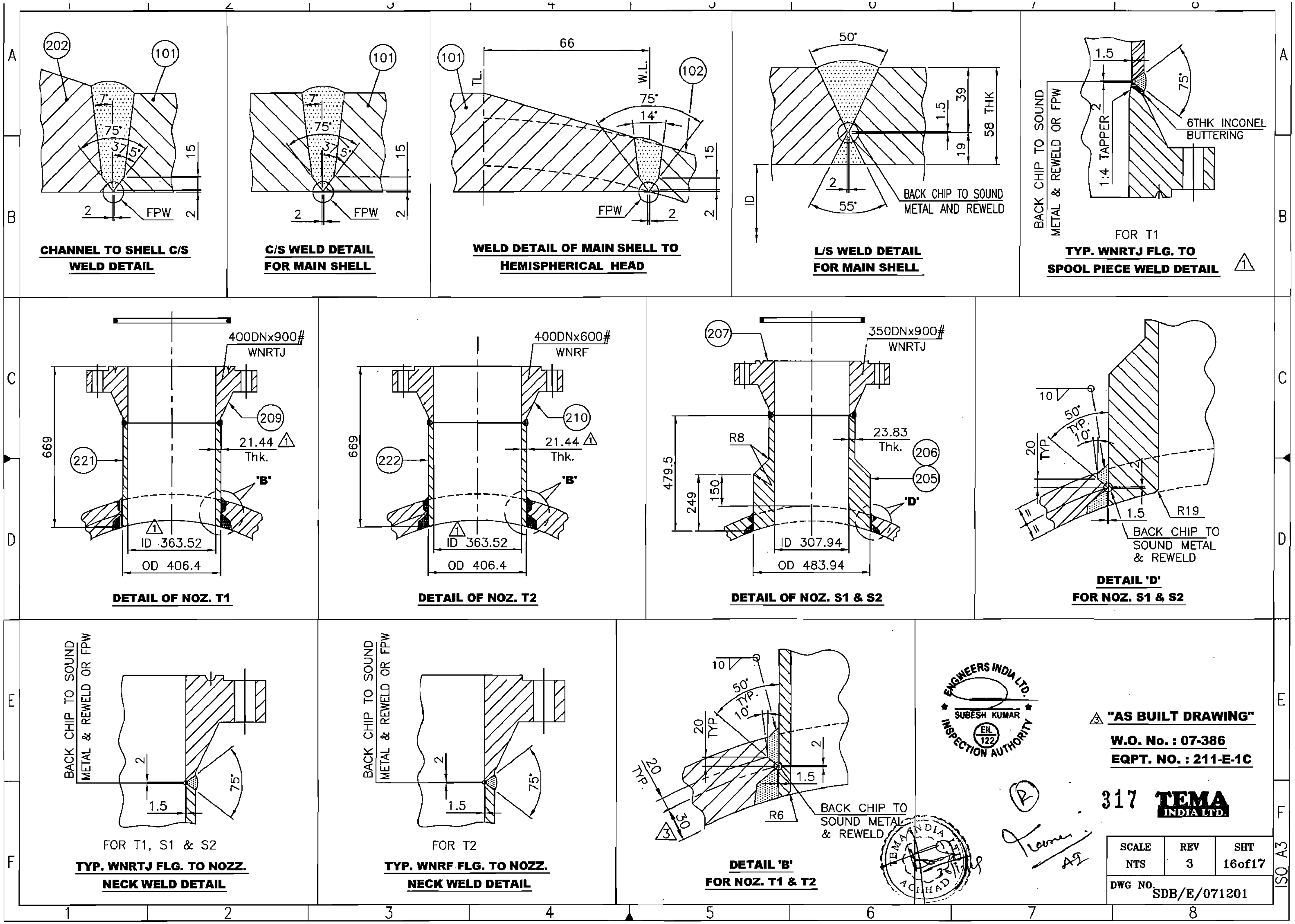
CHANNEL TO SHELL C/S WELD DETAIL
C/S WELD DETAIL FOR MAIN SHELL
WELD DETAIL OF MAIN SHELL TO HEMISPHERICAL HEAD
L/S WELD DETAIL FOR MAIN SHELL
BACK CHIP TO SOUND METAL AND REWELD
58 THK
FOR T1
TYP. WNRTJ FLG. TO SPOOL PIECE WELD DETAIL
BACK CHIP TO SOUND METAL & REWELD OR FPW
1:4 TAPPER
6THK INCONEL BUTTERING
DETAIL OF NOZ. T1
400DNx900# WNRTJ
21.44 Thk.
ID 363.52
OD 406.4
DETAIL OF NOZ. T2
400DNx600# WNRF
DETAIL OF NOZ. S1 & S2
350DNx900# WNRTJ
23.83 Thk.
ID 307.94
OD 483.94
DETAIL 'D' FOR NOZ. S1 & S2
BACK CHIP TO SOUND METAL & REWELD
FOR T1, S1 & S2
TYP. WNRTJ FLG. TO NOZZ. NECK WELD DETAIL
FOR T2
TYP. WNRF FLG. TO NOZZ. NECK WELD DETAIL
DETAIL 'B' FOR NOZ. T1 & T2
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SUBESH KUMAR
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SCALE NTS
REV 3
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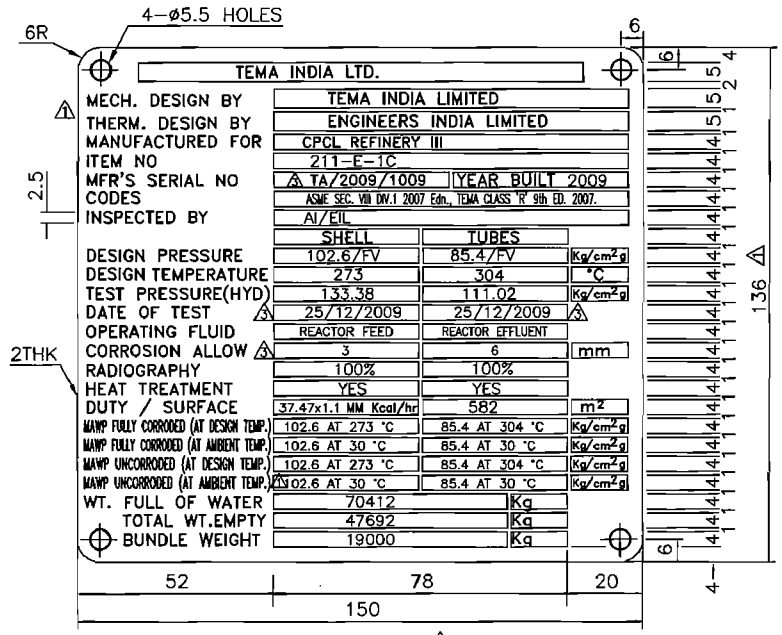
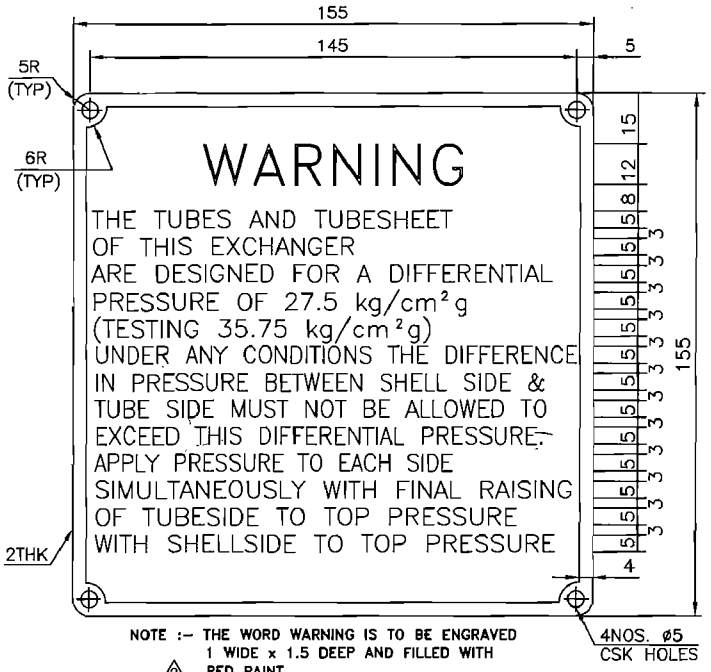


(608) **NAME PLATE**

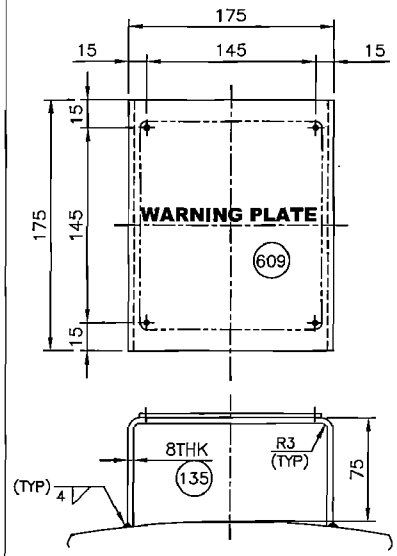
NOTES:-

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. ALL LETTERS AND LETTER BLOCKS SHALL BE ENGRAVED IN BLACK.
3. NAME PLATE SHALL BE RIVETED WITH ø5 ALUMINIUM RIVETS AND TACK WELDED TO BRACKET ON ALL FOUR SIDE.
4. NAME PLATE SHALL BE OF AISI 304 OF 2THK.

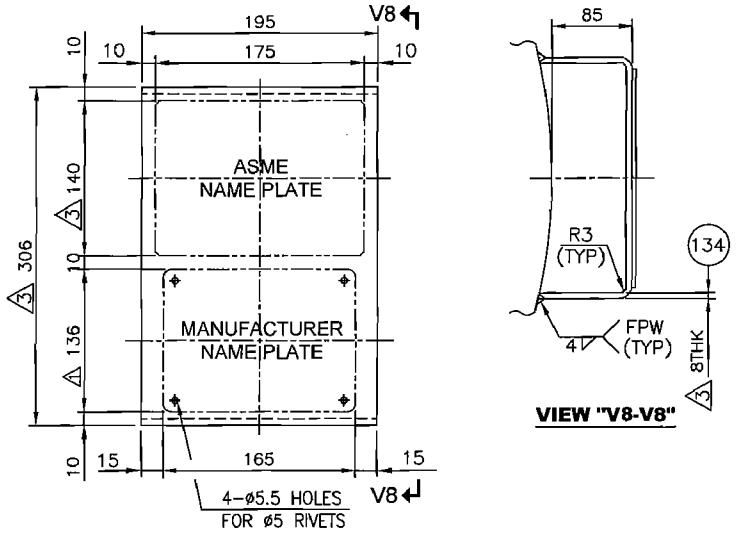


NOTE :- THE WORD WARNING IS TO BE ENGRAVED 1 WIDE x 1.5 DEEP AND FILLED WITH RED PAINT

DETAIL OF WARNING PLATE (609)

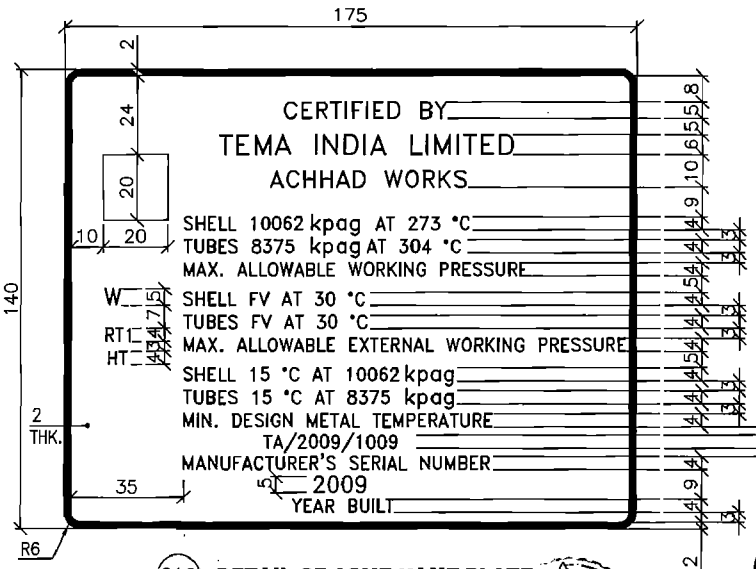


DETAIL OF WARNING PLATE BRACKET



VIEW "V8-V8"

DETAIL OF NAME PLATE BRACKET



(610) **DETAIL OF ASME NAME PLATE**

NOTES:-

1) ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2) ALL LETTERS, BLOCKS, AND BORDER SHALL BE OF RAISED POLISHED FACE.
3) CHARACTERS SHALL BE RAISED AT LEAST 0.1mm & SHALL BE LEGIBLE & READABLE.
4) BACKGROUND SHALL BE BLACK.
5) NAME PLATE SHALL BE OF STAINLESS STEEL TYPE AISI 304 OF 2mm THK.
6) NAME PLATE SHALL BE SEAL WELDED WITH BRACKET

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