DESIGN DATA

CODE OF CONSTRUCTION	ASME SEC. VIII DIV.1 2007 Edn. TEMA CLASS–R 9th EDITION, 2007				SHELL	CHANNEL	
				PWHT	YES	YES	
	UNIT	SHELLSIDE	TUBE SIDE	RADIOGRAPHY	100%	100%	
DESIGN PRESSURE (SEE NOTE-32) △	Kg/Cm²g	102.6/FV@30°C	85.4/FV@30°C	JOINT EFFICIENCY	1.0	1.0	
	kPag	10062/FV@30°C	8375/FV@30°C	INSPECTION BY	AI/EIL		
DESIGN TEMPERATURE	°C	173	224	POSITION	HORIZONTAL	TYPE	DEU
				DUTY	MM Kcal/hr	37.47x1.1	
HYDROTEST PRESSURE (SEE NOTE-33) △	Kg/Cm²g	△2A 133.38	111.02	EARTHQUAKE SPECIFICATION		EIL SPEC-6879-9-2554-0145.	
	kPag	△2A 13080.6	10887.5	WIND LOAD		IS 875	
DIFFERENTIAL DESIGN PRESSURE FOR TUBES/TS.	Kg/Cm²g	27.5		ADDITIONAL LOADING AS PER UG-22		NOZZLE LOADS	
	kPag	△ 2697					
MIN. HYDRO TEST TEMPERATURE	°C	20	20	CODE STAMPING REQUIRED		YES 'U'	
OPERATING PRESSURE △	Kg/Cm²g	87.7	73.0	TOLERANCE	TEMA CLASS R & EIL STD. 7-15-0019 REV.1		
	kPag	8600.5	7159				
OPERATING TEMPERATURE (IN / OUT)	°C	47/106.9	169/121	**MECHANICAL DATA OF EXCHANGER**			
				EFFECTIVE SURFACE AREA	m²	582	
INSIDE DIAMETER	mm	1475	1518	TOTAL WEIGHT (EMPTY)	Kg.	62159	
No. OF PASSES	Nos.	ONE	TWO	TUBE BUNDLE WEIGHT	Kg.	19000	
FLUID CIRCULATED		REACTOR FEED	REACTOR EFFLUENT	HYDRO TEST WEIGHT	Kg.	76543	
INSULATION	mm	25	45	OPERATING WEIGHT	Kg.	70750	
CORRN. ALLOWANCE	mm	SEE NOTE–26		BUNDLE PULLING LOAD	Kg.	38000	
MAWP FULLY CORRODED (AT DESIGN TEMP.) △	10062 kPag AT 173 °C SHELL SIDE			No. OF 'U' TUBES	647	PITCH	32
	8375 kPag AT 224 °C TUBE SIDE			TUBE OD	25	LAYOUT	◇ RT. SQUARE
MAWP FULLY CORRODED (AT AMBIENT TEMP.) △	10062 kPag AT 30 °C SHELL SIDE			TUBE THK. (Min.)	3.0		
	8375 kPag AT 30 °C TUBE SIDE						
MAWP UNCORRODED (AT DESIGN TEMP.) △	10062 kPag AT 173 °C SHELL SIDE			TUBE EFF. LENGTH	5773 (SHELL SIDE FACE OF T/SHT. TO FULL SUPP. PL. INSIDE FACE)		
	8375 kPag AT 224 °C TUBE SIDE						
MAWP UNCORRODED (AT AMBIENT TEMP.) △	10062 kPag AT 30 °C SHELL SIDE			IMPACT TESTED PART NO.	SEE NOTE No. 43 △3		
	8375 kPag AT 30 °C TUBE SIDE						
MDMT △	15 °C AT 10062 kPag SHELL SIDE						
	15 °C AT 8375 kPag TUBE SIDE						

*AS PER GENERAL NOTE–35

NOZZ. No.	SERVICE	SIZE DN	SCH	THK	CLASS	TYPE	*FACE	REMARK
T2B	CHANNEL OUTLET	400	80	21.44	600#	WN	RF	
T1B	CHANNEL INLET	400	80	21.44	600#	WN	RF	
S2B	SHELL OUTLET	350	FORG.	23.80 (19.05) △3	900#	WN	RTJ	
S1B	SHELL INLET	350	FORG.	23.80 (19.05) △3	900#	WN	RTJ	
			NOZZLE SCHEDULE		ASME B16.5 2003 FLANGES			

NOZZLE SCHEDULE

TUBE SIDE ADDITIONAL CONDITIONS :- △

DEPRESSURIZATION PRESSURE	73.0 Kg/cm²g
DEPRESSURIZATION TEMPERATURE	299 °C

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	SR	300	80	620–640	150 Minutes	80	300
CHANNEL BARREL ASSEMBLY	IN CLOSED FURNACE	SR	300	55	620–640	160 Minutes	55	300
INTERNAL CYLINDER ASSEMBLY	IN CLOSED FURNACE	SR	300	100	620–640	150 Minutes	100	300
MAIN SHELL TO BARREL JOINT	BY HEAT RESISTANCE COIL	SR	300	75	620–640	150 Minutes	75	300
TUBE TO TUBESHEET JOINT	ELECTRICAL RESISTANCE	SR	300	100	620–640	60 Minutes	100	300
'U' TUBE AFTER FORMING 'U' BEND+300mm FROM TL (R1 TO R4)	IN CLOSED FURNACE	SR	300	150	620–640	30 Minutes	150	300

AS BUILT

TEMA INDIA LTD. ACHHAD 8/01/10

Reviewed Kumar 08/01/2010 AI

ENGINEERS INDIA LTD. * SUBESH KUMAR * EIL 122 INSPECTION AUTHORITY

REV.	DATE	DESCRIPTION	DRWN	CHKD	APPD
3	07.01.2010	AS BUILT DIMENSIONS ARE SHOWN IN BKT (--) AS MARKED △3 AND OTHER CHANGES AS MARKED △3 THUS.	PRASHANT	VED	GDP
2A	23.02.2009	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	08.09.2008	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-607,BSEL Tech Park, Opp.Vashi Station, Navi Mumbai-400705)

CONSULTANT :

ENGINEERS INDIA LIMITED

CLIENT :

CPCL REFINERY III 256

TITLE :	**FIRST REACTOR FEED / EFFLUENT EXCHANGER**			W.O. No.	07-386
				EQPT. NO.	211-E-1F
JOB NO.	EIL	6879	P.O. No.	6879/6010/1008/018 DT. 27/02/2008	
	TEMA	T/E/071204	PR No.	6879-211-EE-PR-6020/0018 Rev.0 DT. 03/04/2008	
SCALE	NTS	DWG. No.	SDB/E/071204	SHT. NO. 1 of 18	Rev. 0 1 2 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, 7-15-0005 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] b) 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.
c) GASKET CONTACT SURFACES SHALL BE PROTECTED WITH RUST PREVENTIVE COMPOUND.

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Reviewed Tema. 28/01/2010

ENGINEERS INDIA LTD. SUBESH KUMAR INSPECTION AUTHORITY

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	6mm
CHANNEL	6mm
TUBE SHEET	12mm

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] STACKED EXCHANGERS (211-E-1E & 211-E-1F) SHALL BE HYDROTESTED IN STACKED CONDITION.
39] ALL FABRICATION TOLERANCES SHOULD BE AS PER TIL-MFG-WI-26 REV.0 PAGE 1 TO 10. UNLESS OTHERWISE SPECIFIED.
40] ALL CARBON STEEL MATERIALS IN CONTACT WITH SHELL SIDE AND TUBE SIDE FLUIDS SHALL MEET ⚠1 REQUIREMENTS SPECIFIED IN AXENS SPECIFICATION IN 42.0. SHELL SIDE AND TUBE SIDE CARBON STEEL MATERIALS SHALL ALSO COMPLY WITH HIC RESISTANT MATERIAL REQUIREMENTS AS PER AXENS SPECIFICATION IN 43.0
42] TORQUE TABLE (MAX. ALLOWABLE TORQUE) **"AS BUILT DRAWING"** ⚠3

⚠2

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

W.O. No. : 07-386
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43] IMPACT TEST SHALL BE CARRIED OUT FOR ⚠3 PART NO. 101, 102, 205, 206, 115, 116, 201, 202 203, 204, 211 TO 214 & 219 AT -29 °C.

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ISO A3

P.No.	DESCRIPTION	SIZE	MATERIAL SPECIFIED.	QTY	REMARK
	TUBES				
302	SPACER	OD21.4x2.65THKxLG. AS PER TABLE	IS 1239	AS PER TABLE	
301	'U' TUBES	OD25x3.0THK(Min.)xLG. AS PER TABLE	SA 179	647	
	FORGING				
219	FORGE NECK FOR T1B & T2B	OD406.4xID363.52x483LG.	SA266 Gr.4	2	
218	PULLING EYE BOLT	M-36 AS PER DETAIL	SA 105	4	
217	PLUG FOR PULLING EYE BOLT	M-36 AS PER DETAIL	SA516 Gr.60	4	
216	SEAL RING FOR T2B ⚠1	68THK AS PER DETAIL	SA266 Gr.4	1	
215	ADDED STEEL (PROPRIETARY)	-	-	1	
214	INNER COMPRESSION RING ⚠1	OD1390xID1326x35THK	SA266 Gr.4	1	
213	OUTER COMPRESSION RING	OD1574xID1516x39.6THK	SA266 Gr.4	1	
212	INTERNAL FLANGE ⚠1	OD1526.5xID1328x179THK	SA266 Gr.4	1	
211	SPLIT RING	OD1552xID1501x38THK	SA266 Gr.4	1	
210	COMPANION NOZZ. FLG. FOR T2B	400DNxSCH.80x600#WNRF ⚠3	SA 105	1	⚠
209	NOZZLE FLANGE FOR T1B & T2B	400DNxSCH.80x600#WNRF ⚠3	SA 105	2	
208	COMPANION NOZZ. FLG. FOR S1B ⚠1	350DNxSCH.100x900#WNRTJ	SA 105	1	⚠
207	NOZZLE FLANGE FOR S1B & S2B ⚠1	350DNxSCH.100x900#WNRTJ	SA 105	2	
206	FORGE NECK FOR S2B ⚠1	OD493.5xID308x481LG.	SA266 Gr.4	1	(ID 317.5) ⚠3
205	FORGE NECK FOR S1B ⚠1	OD493.5xID308x481LG.	SA266 Gr.4	1	(ID 317.5) ⚠3
204	CHANNEL COVER	ø1520.5x217THK	SA266 Gr.4	1	
203	THREADED LOCK RING	OD1612.21xID1468x290.83THK	SA266 Gr.4	1	
202	CHANNEL BARREL	AS PER DETAIL	SA266 Gr.4	1	
201	TUBE SHEET	OD1515x166THK	SA266 Gr.4	1	

P.No.	DESCRIPTION	SIZE	MATERIAL SPECIFIED.	QTY	REMARK
⚠3 146	GUSSET FOR INNER CYLINDER	60x60x16THK	SA516 Gr.60	20	
145	WARNING PLATE BRACKET	8THK AS PER DETAIL	SA516 Gr.60	1	
144	NAME PLATE BRACKET	8THK AS PER DETAIL	SA516 Gr.60	1	
143	PL. FOR LIFTING DEVICE	30THK (32THK) ASPER DETAIL ⚠3	SA516 Gr.70	1	
142	PL. FOR LIFTING DEVICE	30THK (32THK) ASPER DETAIL ⚠3	SA516 Gr.70	1	
141	EARTHING CLEAT	100x75x10THK	SA516 Gr.60	2	
140	SHIM PLATE FOR FIXED SADD. SIDE	1890x350x THK TO SUIT	AISI 304	1	
139	SHIM PLATE FOR SLIDING SADD. SIDE	2090x350x THK TO SUIT	AISI 304	1	
138	RIB PL. FOR SLIDING SADD SUPP.	2432x330x20THK	SA516 Gr.60	2	
137	RIB PL. FOR FIXED SADD SUPP. FOR TOP	564x155x20THK	SA516 Gr.60	4	
136	RIB PL. FOR FIXED SADD SUPP. FOR TOP	775x155x20THK	SA516 Gr.60	4	
135	RIB PL. FOR FIXED SADD SUPP. FOR BTM.	252x155x20THK	SA516 Gr.60	4	
134	RIB PL. FOR FIXED SADD SUPP. FOR BTM.	462x155x20THK	SA516 Gr.60	4	
133	WEB PL. FOR FIXED SADD SUPP.	1820x2432x20THK	SA516 Gr.60	1	
132	WEAR PL. FOR FIXED SADD SUPP.	5168°x350x20THK	SA516 Gr.60	1	
131	BASE PL. FOR FIXED SADD. SUPP. FOR TOP	1890x350x25THK	SA516 Gr.60	1	
130	BASE PL. FOR FIXED. SADD. SUPP. FOR BTM.	1890x350x40THK	SA516 Gr.60	1	
129	RIB PL. FOR SLIDING SADD SUPP.	2432x330x20THK	SA516 Gr.60	2	
128	RIB PL. FOR SLIDING SADD SUPP. FOR TOP	437x155x20THK	SA516 Gr.60	4	
127	RIB PL. FOR SLIDING SADD SUPP. FOR TOP	691x155x20THK	SA516 Gr.60	4	
126	RIB PL. FOR SLIDING SADD SUPP. FOR BTM.	124x155x20THK	SA516 Gr.60	4	
125	RIB PL. FOR SLIDING SADD SUPP. FOR BTM.	381x155x20THK	SA516 Gr.60	4	
124	WEB PL. FOR SLIDING SADD SUPP.	2020x2432x20THK	SA516 Gr.60	1	
123	WEAR PL. FOR SLIDING SADD SUPP.	6007°x350x20THK	SA516 Gr.60	1	
122	BASE PL. FOR SLIDING SADD. SUPP. FOR TOP	2090x350x25THK	SA516 Gr.60	1	
121	BASE PL. FOR SLIDING SADD. SUPP. FOR BTM.	2090x350x40THK	SA516 Gr.60	1	
120	GASKET RETAINER	ø1557x20THK	SA240 Gr.321	1+1	
119	INTERNAL SLEEVE	4266°x87Wx30THK ⚠1	SA516 Gr.60	1	
118	RETAINING RING FOR T2B	OD437.7xID413.7x3THK	SA240 Gr.321	1	
117	PARTITION COVER PLATE	32THK AS PER DETAIL ⚠1	SA516 Gr.60	1	
116	END PALTE	OD1515x26THK	SA516 Gr.60	1	
115	PLATE FOR INTERNAL CYLINDER	4672°x734x28THK ⚠1	SA516 Gr.60	1	
114	PASS PARTITION PLATE	1459x734x36THK ⚠1	SA516 Gr.60	1	
113	SEALING STRIP	5814x60Wx8THK	SA516 Gr.60	2	
112	SEALING STRIP	3666x150Wx8THK	SA516 Gr.60	2	
111	SEALING STRIP	4166x150Wx8THK	SA516 Gr.60	2	
110	SLIDING STRIP	5814x70Wx20THK	SA516 Gr.60	2	
109	SUPPORT PLATE 'C'	16THK AS PER DETAIL	SA516 Gr.60	1	
108	PARTIAL SUPPORT PLATE 'S1'	16THK AS PER DETAIL	SA516 Gr.60	1	
107	PARTIAL SUPPORT PLATE 'S'	16THK AS PER DETAIL	SA516 Gr.60	1	
106	BAFFLE PLATE 'D'	16THK AS PER DETAIL	SA516 Gr.60	1	
105	BAFFLE PLATE 'B'	16THK AS PER DETAIL	SA516 Gr.60	5	
104	BAFFLE PLATE 'A1'	16THK AS PER DETAIL	SA516 Gr.60	1	
103	BAFFLE PLATE 'A'	16THK AS PER DETAIL	SA516 Gr.60	4	
102	HEMI HEAD DISHED END	45THK Nom.	SA516 Gr.60	1	
101	MAIN SHELL	4869°x5853x75THK	SA516 Gr.60	1	

PLATES

BILL OF MATERIALS

ASBUILT

TEMA INDIA LTD. ACHHEJA 10

⚠3 **"AS BUILT DRAWING"**

W.O. No. : 07-386

DEPT. NO. : 211-E-1F

ENGINEERS INDIA LTD. SUBESH KUMAR

Reviewed 08/11/2010 AS

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SCALE	REV	SHT
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DWG NO. SDB/E/071204

ISO A3

	P.No.	DESCRIPTION	SIZE	MATERIAL SPECIFIED.	QTY	REMARK
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.	SA516 Gr.60	2	
	606	SEAL ROD	ø25x4116LG.	IS 2062	46	
	605	PUSH ROD	ø25x119LG. ⚠1	SA193 Gr.B16	76+76	
	604	PUSH ROD	ø22x275LG. ⚠1	SA193 Gr.B16	92+92	
	603	PUSH ROD	ø25x146LG. ⚠1	SA453 Gr.660B	80+80	
	602	IMPINGEMENT ROD	ø25x1200LG.	IS 2062	27	
	601	TIE ROD	ø12x5837LG.	IS 2062	22	
FASTENERS	513	STUD-2NUTS FOR T2B COMP. FLG.	1½" UN8x290 LG.	SA193 Gr.B7 /	20+4	⚠3
	512	STUD-2NUTS FOR S1B COMP. FLG.	1½" UN8x315 LG.	SA194 Gr.2H	20+4	⚠3
	511	BOLT WITH NUT & WASHER FOR SADDLE SUPP.	M-42x140 LG.	SA193 Gr.B7/SA194 Gr.2H	16	
	510	STUD-2NUTS FOR NOZZ. T2A & T1B	1½" UN8x290 LG.	SA193 Gr.B7/	20+4	⚠3
	509	STUD-2NUTS FOR NOZZ. S1A & S2B	1½" UN8x315 LG.	SA194 Gr.2H	20+4	⚠3
	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-12x78LG. ⚠1	SA193 Gr.B8T CL.2+	52	
	501	HEX. HD.SCREW WITH LOCKNUT	M-10x45 LG.	SA194 Gr.8T	28	
GASKETS	409	GASKET FOR T2B COMP. FLG.	400DNx600#x4.5THK	AISI 304 SPWD	1+4+2	
	408	GASKET FOR S1B COMP. FLG.	350DNx900# ASME RING No.62	SOFT IRON	1+4+2	HARDNESS 90BHN Max. (OCTAGONAL RING)
	407	GASKET FOR T2A & T1B	400DNx600#x4.5THK	AISI 304 SPWD	1+4+2	
	406	GASKET FOR S1A & S2B	350DNx900# ASME RING No.62	SOFT IRON	1+4+2	HARDNESS 90BHN Max. (OCTAGONAL RING)
	405	PACKING SEAL FOR T2B	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	OD1515xID1460.8x1.6THK	SA240 Gr.321	1+4+2	
	401	GASKET	OD1507xID1481x6.35THK	AISI 321 SPWD	1+4+2	SEE NOTE-16

BILL OF MATERIALS

AS BUILT

TEMA INDIA LTD. ACTIVITY DATE 08/01/10

Reviewed
08/01/2010
AS

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⚠3 "AS BUILT DRAWING"

W.O. No. : 07-386

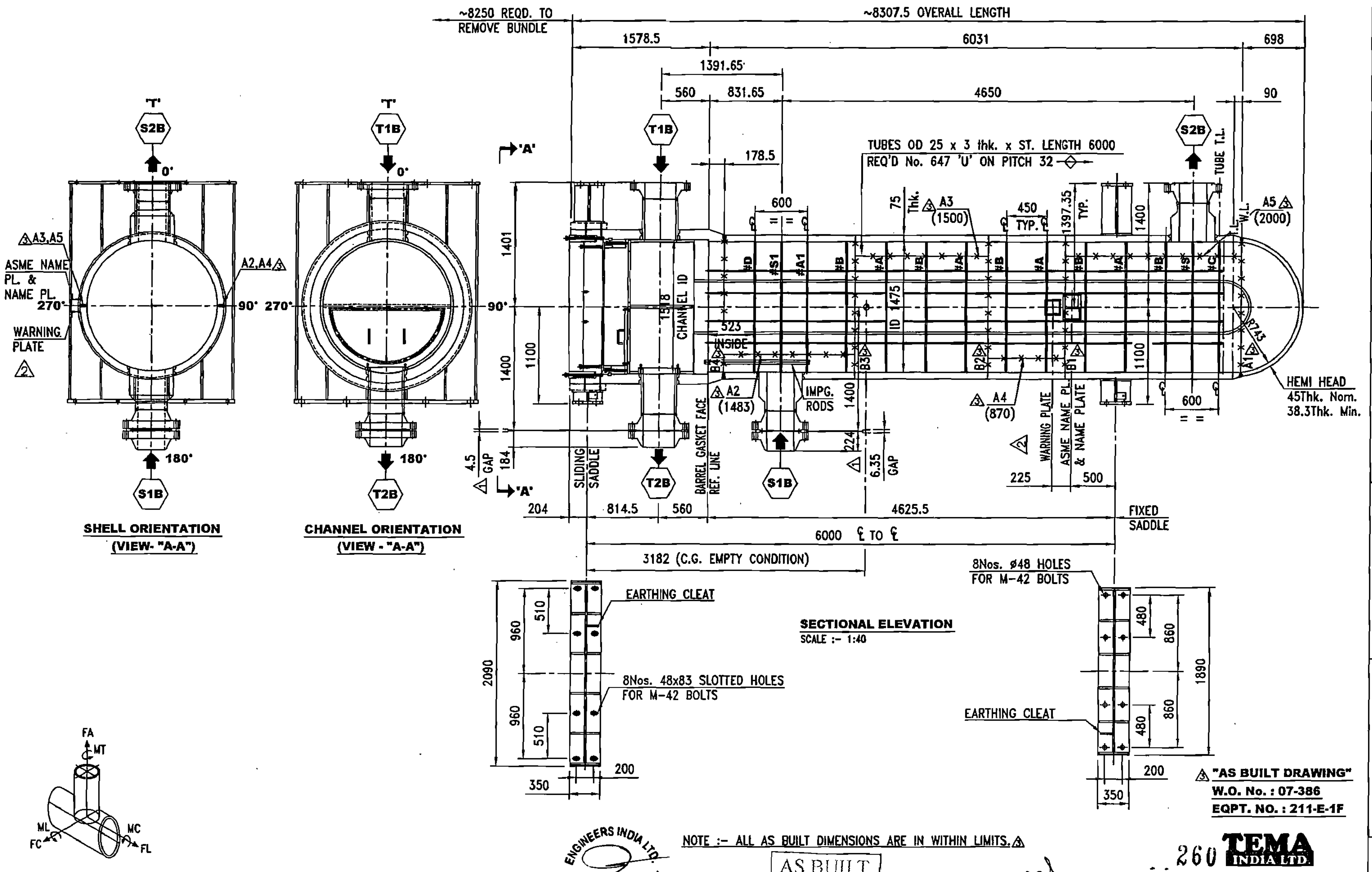
EQPT. NO. : 211-E-1F

259 TEMA INDIA LTD.

SCALE	REV	SHT
NTS	3	4of18

DWG NO. SDB/E/071204

ISO A3



NOZZLE LOAD/MOMENT

NOZZLE	SIZE	FA (kgf)	FL (kgf)	FC (kgf)	MT (kgf-m)	ML (kgf-m)	MC (kgf-m)
S1A & S2A	14"	2362	3500	3500	6124	4900	3674
T1A & T2A	16"	2700	4000	4000	8000	6400	4800

NOTE :- ALL AS BUILT DIMENSIONS ARE IN WITHIN LIMITS.

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AS BUILT

Reviewed 08/01/2010

"AS BUILT DRAWING"
W.O. No. : 07-386
EQPT. NO. : 211-E-1F

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SCALE	REV	SHT
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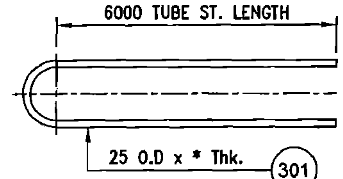
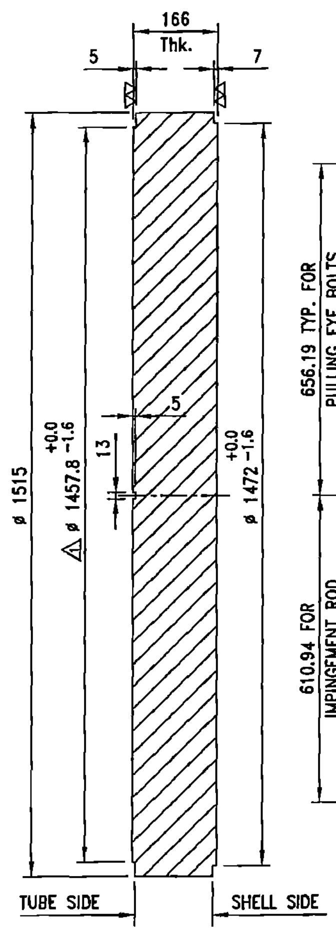
DOME HEIGHT FOR TOP NOZZLE = 136.69
DOME HEIGHT FOR BOTTOM NOZZLE = 91.43

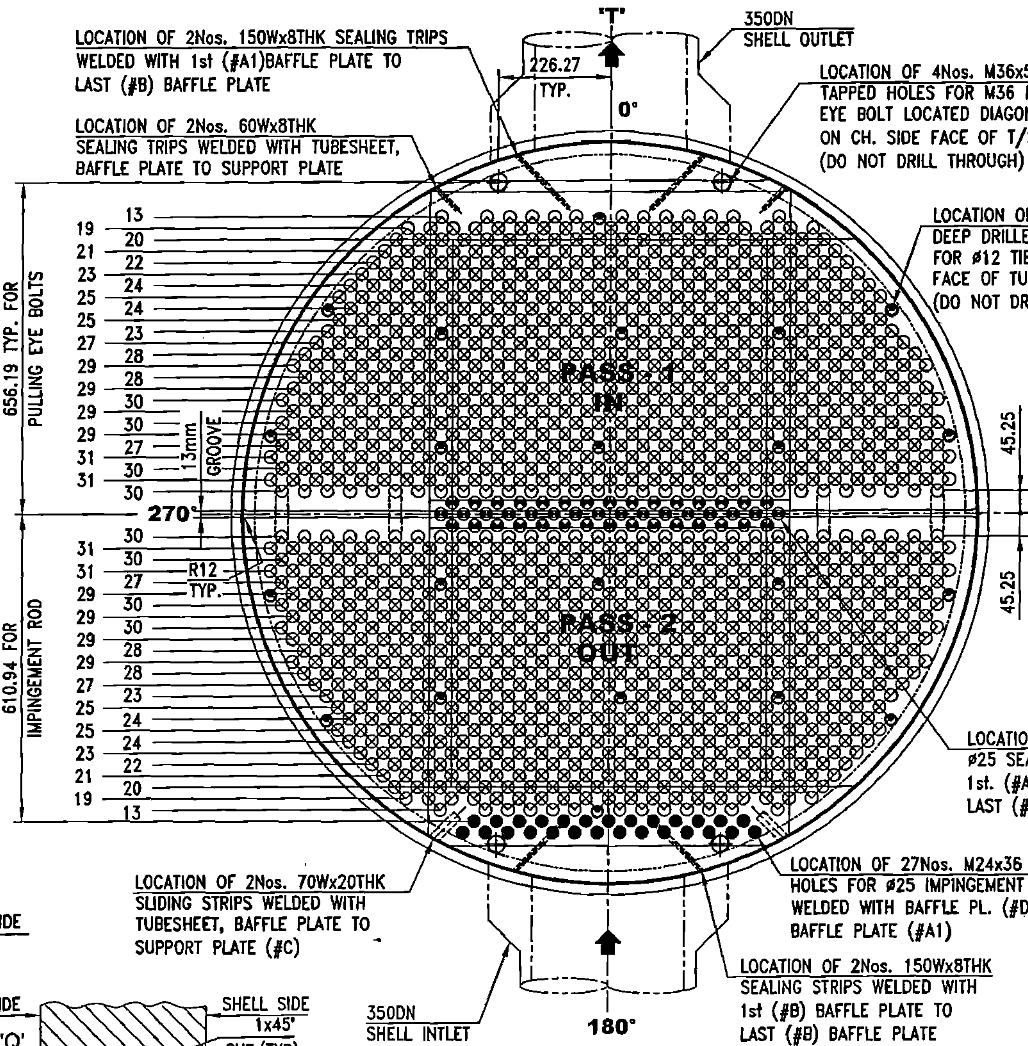


*AS PER GENERAL NOTE No.-31

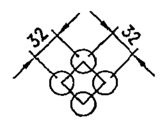
No.	'R' RADIUS	QTY.	'U' TUBE TOTAL LENGTH
1	R1 = 45.25	30	12142
2	R2 = 67.877	31	12213
3	R3 = 90.505	30	12284
4	R4 = 113.132	31	12355
5	R5 = 135.760	27	12427
6	R6 = 158.387	29	12498
7	R7 = 181.015	30	12569
8	R8 = 203.642	29	12640
9	R9 = 226.270	30	12711
10	R10 = 248.897	29	12782
11	R11 = 271.524	28	12853
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





TUBESHEET LAYOUT
VIEW FROM "A-A"
(REF. SHT. 5 of 18)
SCALE:- 1:10

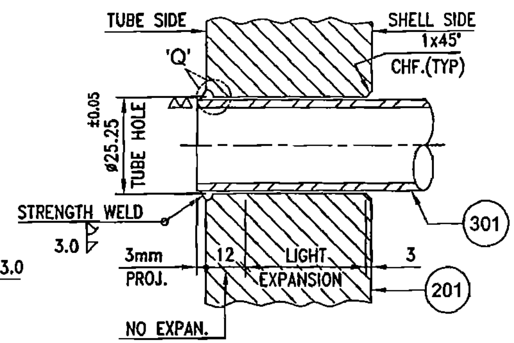


TUBE PITCH

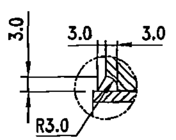
PASS	1	2
TUBE	647	647

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

- DENOTE TUBE HOLES
- DENOTE TIEROD HOLES
- DENOTE SEAL RODS
- DENOTE IMPINGEMENT RODS
- DENOTE PULLING EYE BOLTS



TUBE TO TUBE SHEET JOINT
SCALE:-NTS.



DETAIL-'Q'

AS BUILT

AS BUILT DRAWING

W.O. No. : 07-386

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SCALE	REV	SHT
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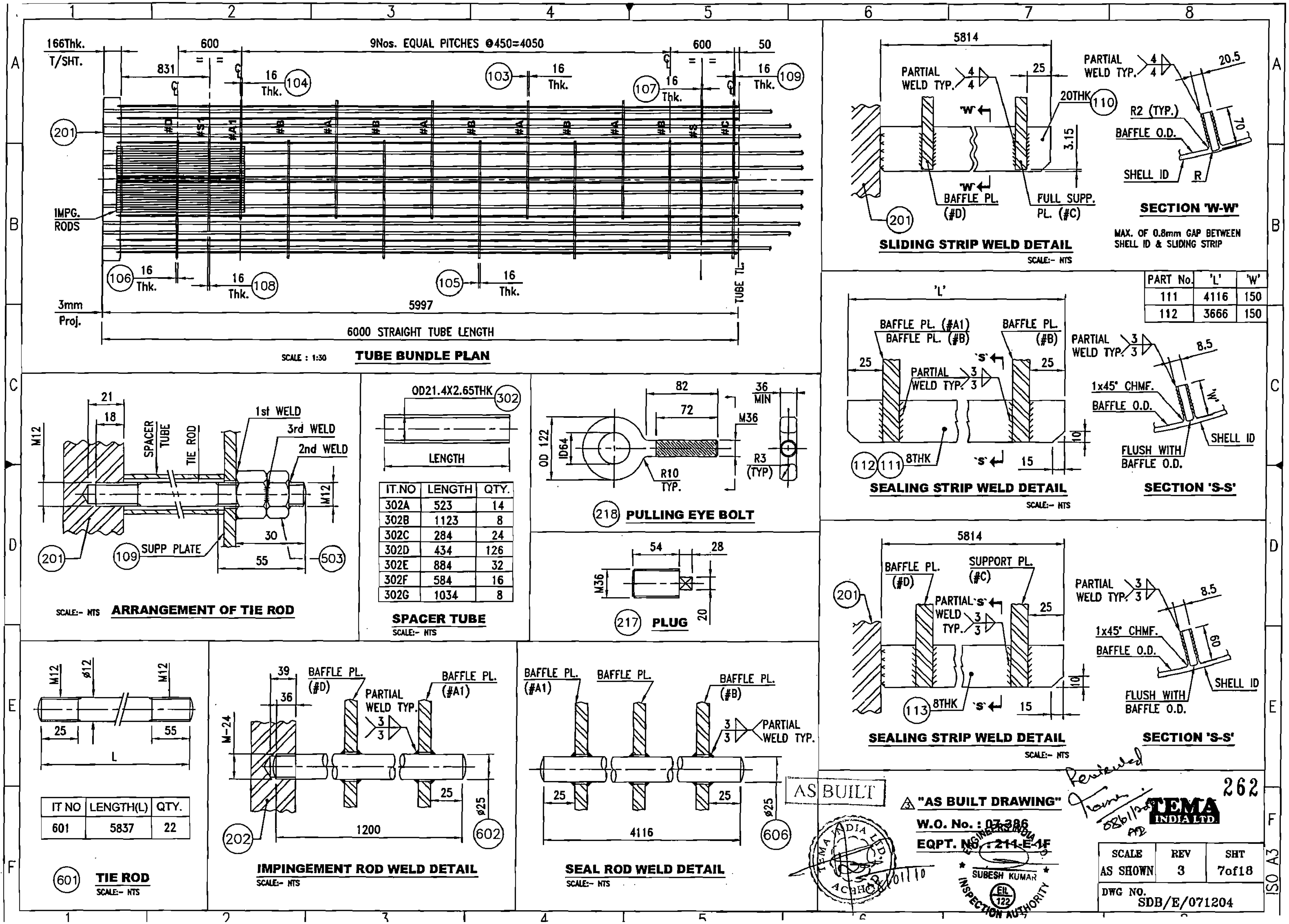
TUBE BUNDLE PLAN
SCALE : 1:30
166Thk. T/SHT.
9Nos. EQUAL PITCHES @450=4050
600
831
50
16 Thk.
3mm Proj.
IMPG. RODS
5997
6000 STRAIGHT TUBE LENGTH
TUBE TL.
#D #S1 #A1 #B #A #B #A #B #A #B #A #B #S #C
SLIDING STRIP WELD DETAIL
SCALE:- NTS
5814
PARTIAL WELD TYP. 4/4
20THK
FULL SUPP. PL. (#C)
BAFFLE PL. (#D)
3.15
25
SECTION 'W-W'
20.5
70
R2 (TYP.)
BAFFLE O.D.
SHELL ID
R
MAX. OF 0.8mm GAP BETWEEN SHELL ID & SLIDING STRIP
SEALING STRIP WELD DETAIL
SCALE:- NTS
'L'
BAFFLE PL. (#A1)
BAFFLE PL. (#B)
PARTIAL WELD TYP. 3/3
8THK
15
10
SECTION 'S-S'
8.5
1x45° CHMF.
'W'
FLUSH WITH BAFFLE O.D.
SUPPORT PL. (#C)
BAFFLE PL. (#D)
60
ARRANGEMENT OF TIE ROD
SCALE:- NTS
M12
21
18
SPACER TUBE
TIE ROD
1st WELD
3rd WELD
2nd WELD
SUPP PLATE
30
55
SPACER TUBE
SCALE:- NTS
OD21.4X2.65THK
LENGTH
PULLING EYE BOLT
82
72
M36
36 MIN
OD 122
ID64
R10 TYP.
R3 (TYP)
PLUG
54
28
M36
20
TIE ROD
SCALE:- NTS
M12
ø12
25
55
L
IMPINGEMENT ROD WELD DETAIL
SCALE:- NTS
39
36
M-24
BAFFLE PL. (#D)
BAFFLE PL. (#A1)
PARTIAL WELD TYP. 3/3
1200
ø25
SEAL ROD WELD DETAIL
SCALE:- NTS
BAFFLE PL. (#A1)
BAFFLE PL.
BAFFLE PL. (#B)
4116
AS BUILT
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PART No.	'L'	'W'
111	4116	150
112	3666	150

IT.NO	LENGTH	QTY.
302A	523	14
302B	1123	8
302C	284	24
302D	434	126
302E	884	32
302F	584	16
302G	1034	8

IT NO	LENGTH(L)	QTY.
601	5837	22

SCALE	REV	SHT
AS SHOWN	3	7of18

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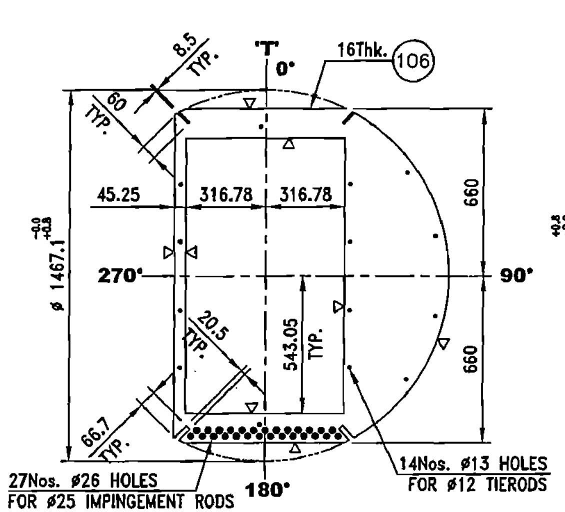
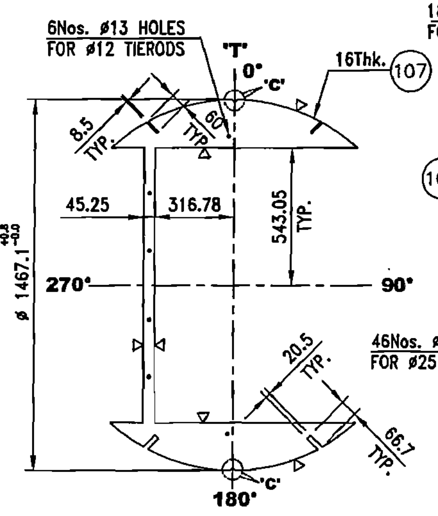
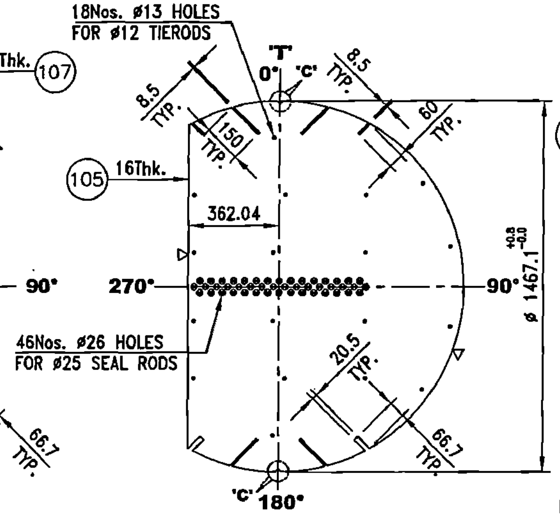


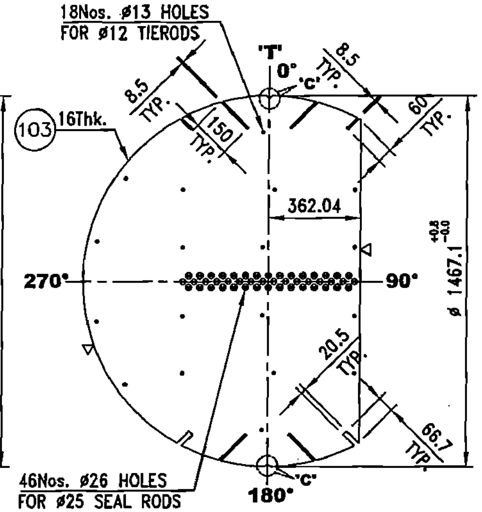
DETAIL OF BAFFLE PLATE
TYPE "D" SCALE : 1:20



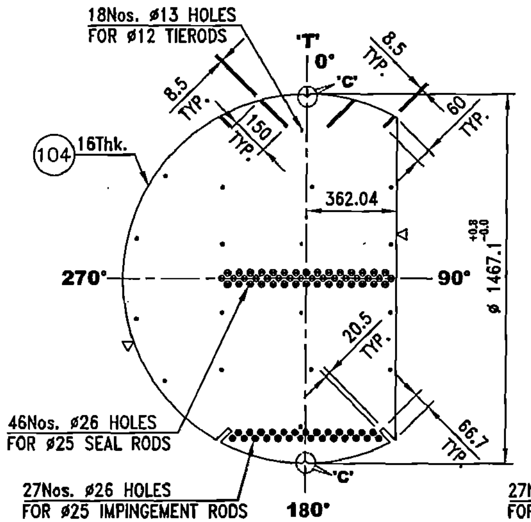
DETAIL OF BAFFLE PLATE
TYPE "S" SCALE : 1:20



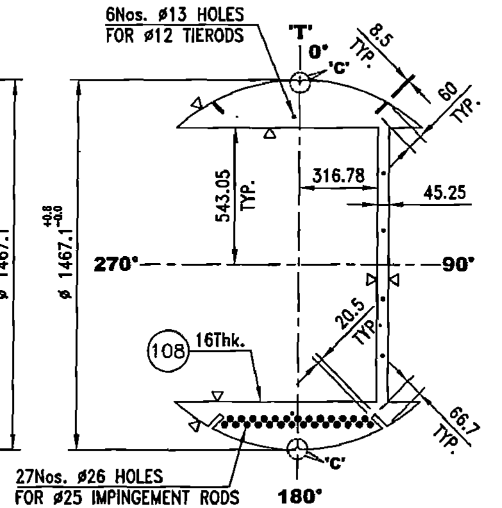
DETAIL OF BAFFLE PLATE
TYPE "B" SCALE : 1:20



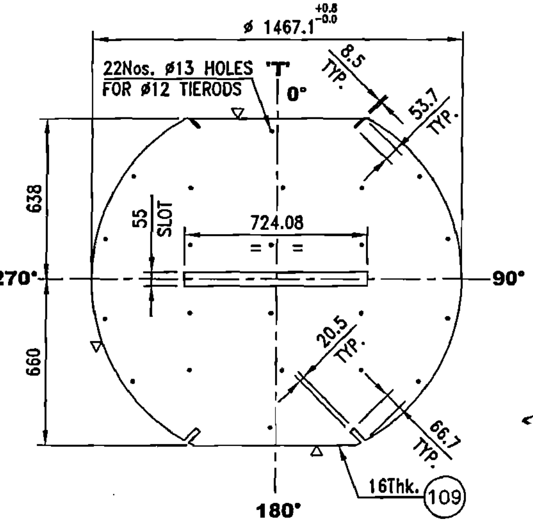
DETAIL OF BAFFLE PLATE
TYPE "A" SCALE : 1:20



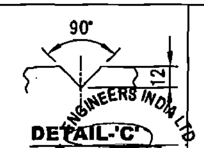
DETAIL OF BAFFLE PLATE
TYPE "A1" SCALE : 1:20



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



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



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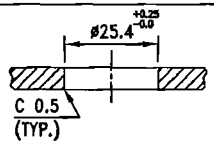
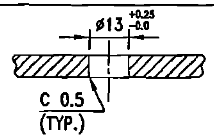
AS BUILT

NOTES :-

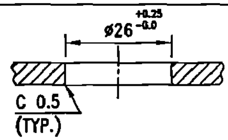
1) TUBE HOLE $\phi 25.4^{+0.25}_{-0.00}$ TO BE DRILLED AS PER T/SHT. LAYOUT IN THE BAFFLE & SUPP. PLATES.
2) SEALING & SLIDING STRIPS LOCATION AS PER T/SHT. LAYOUT.
3) TIEROD & IMPINGEMENT ROD LOCATION AS PER T/SHT. LAYOUT.
4) SEAL ROD LOCATION AS PER T/SHT. LAYOUT.



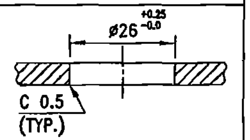
TYP. DETAIL FOR TUBE HOLE



TYP. DETAIL FOR FOR TIEROD HOLE



TYP. DETAIL FOR IMPG. ROD HOLE



TYP. DETAIL FOR SEAL ROD HOLE

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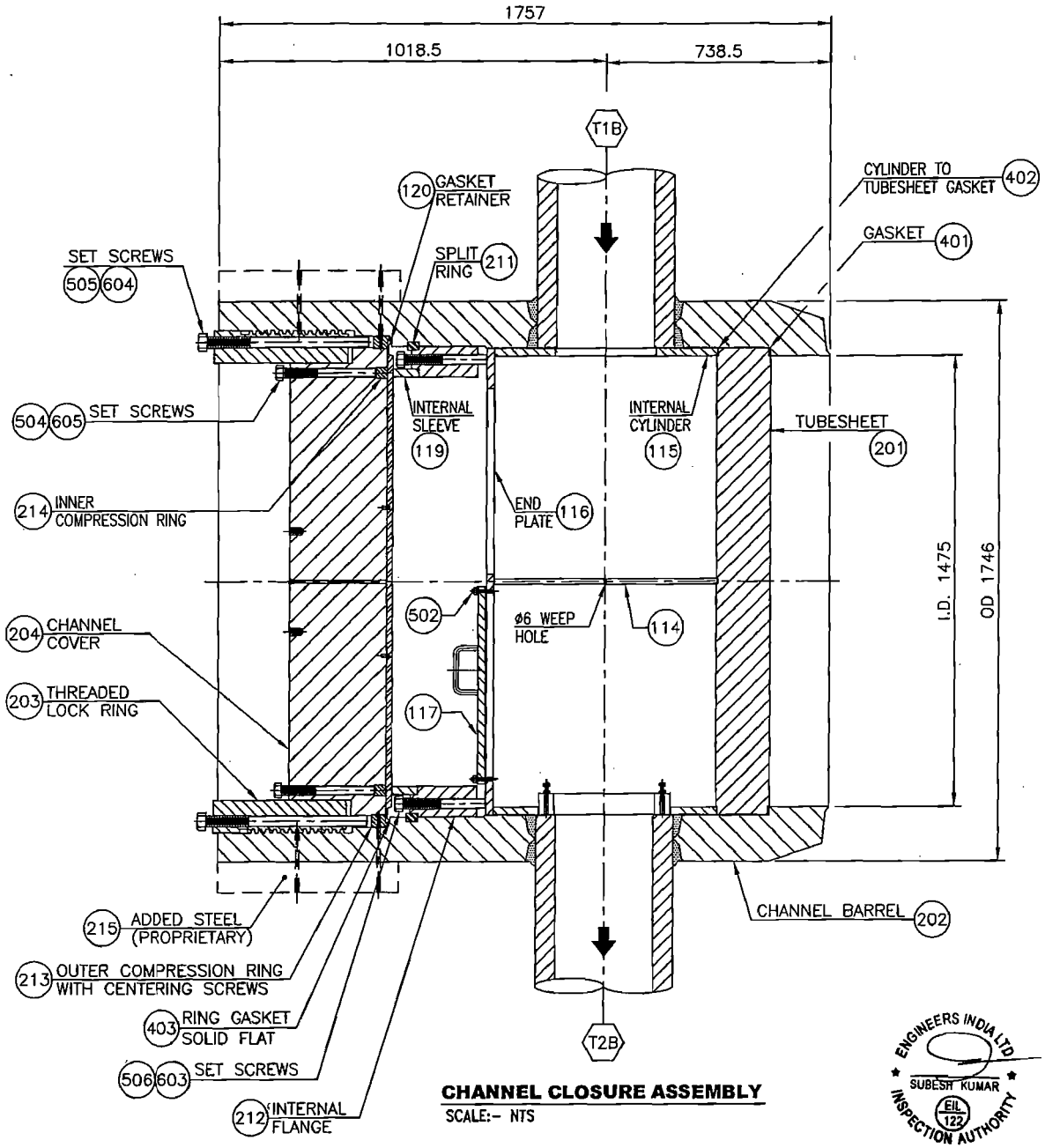
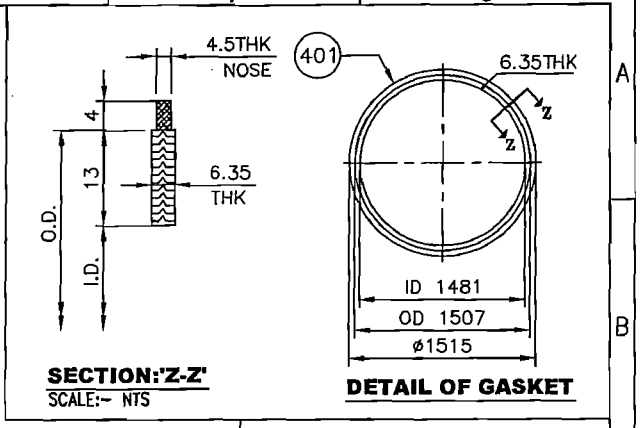
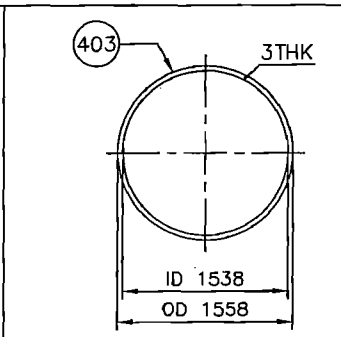


CHANNEL CLOSURE ASSEMBLY
SCALE:- NTS



SECTION:'Z-Z'
SCALE:- NTS

DETAIL OF GASKET



DETAIL OF GASKET
SCALE:- NTS

AS BUILT

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08/11/2010

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SCALE	REV	SHT
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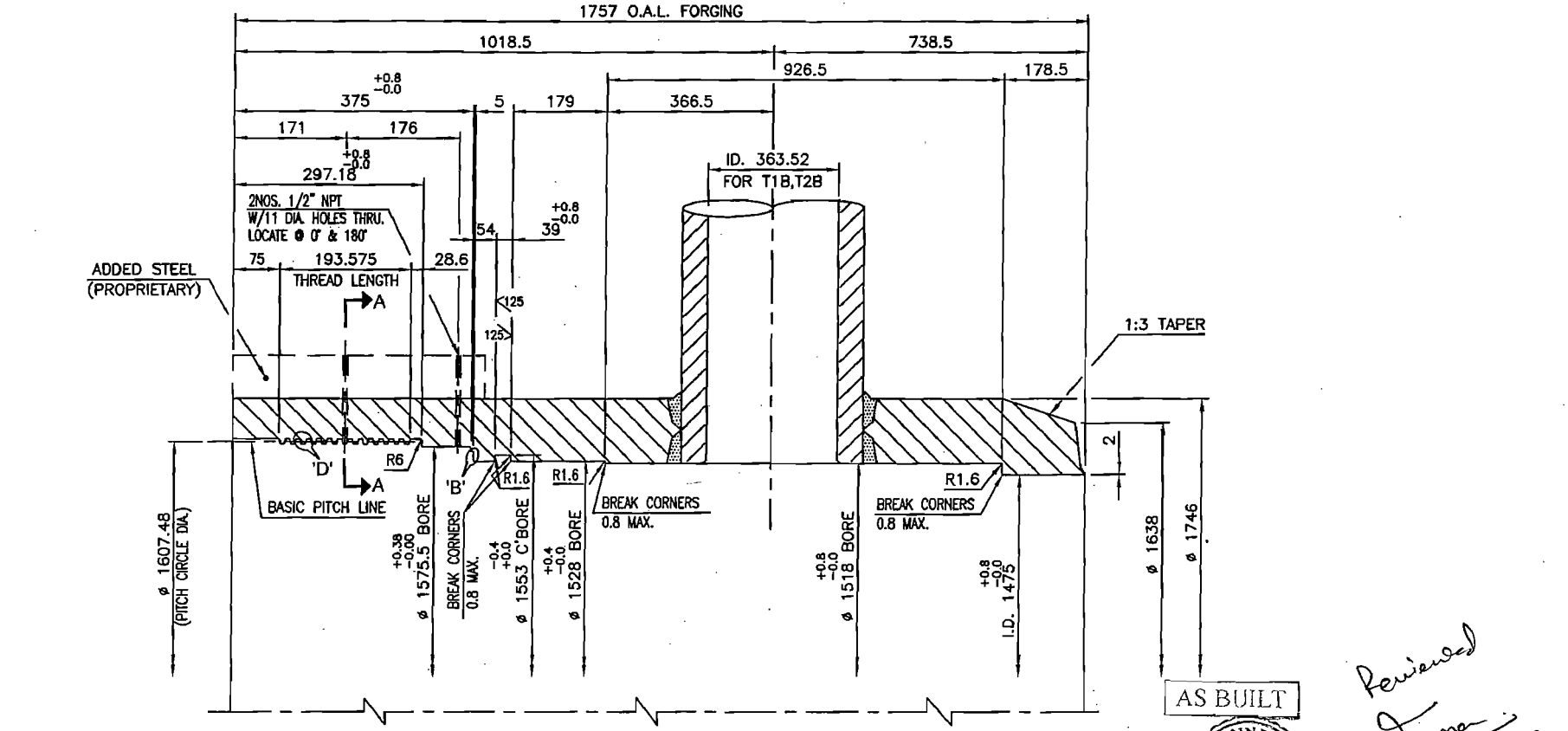
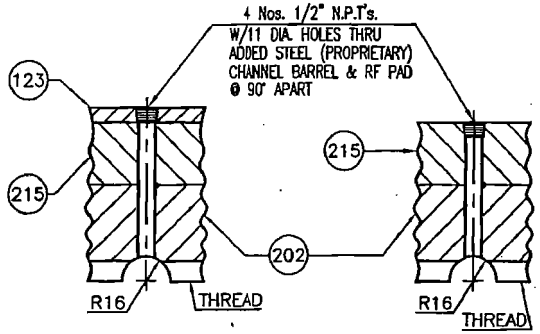
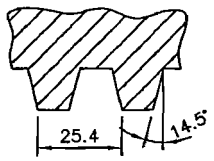


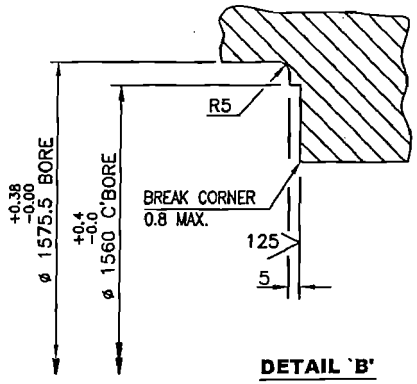
DETAIL OF CHANNEL BARREL
SCALE:– NTS



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

AS BUILT

TEMA INDIA LTD. ACHEMA DIV.

Reviewed
Thana
08/01/2010
AS

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⚠3 **"AS BUILT DRAWING"**

W.O. No. : 07-386

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SCALE	REV	SHT
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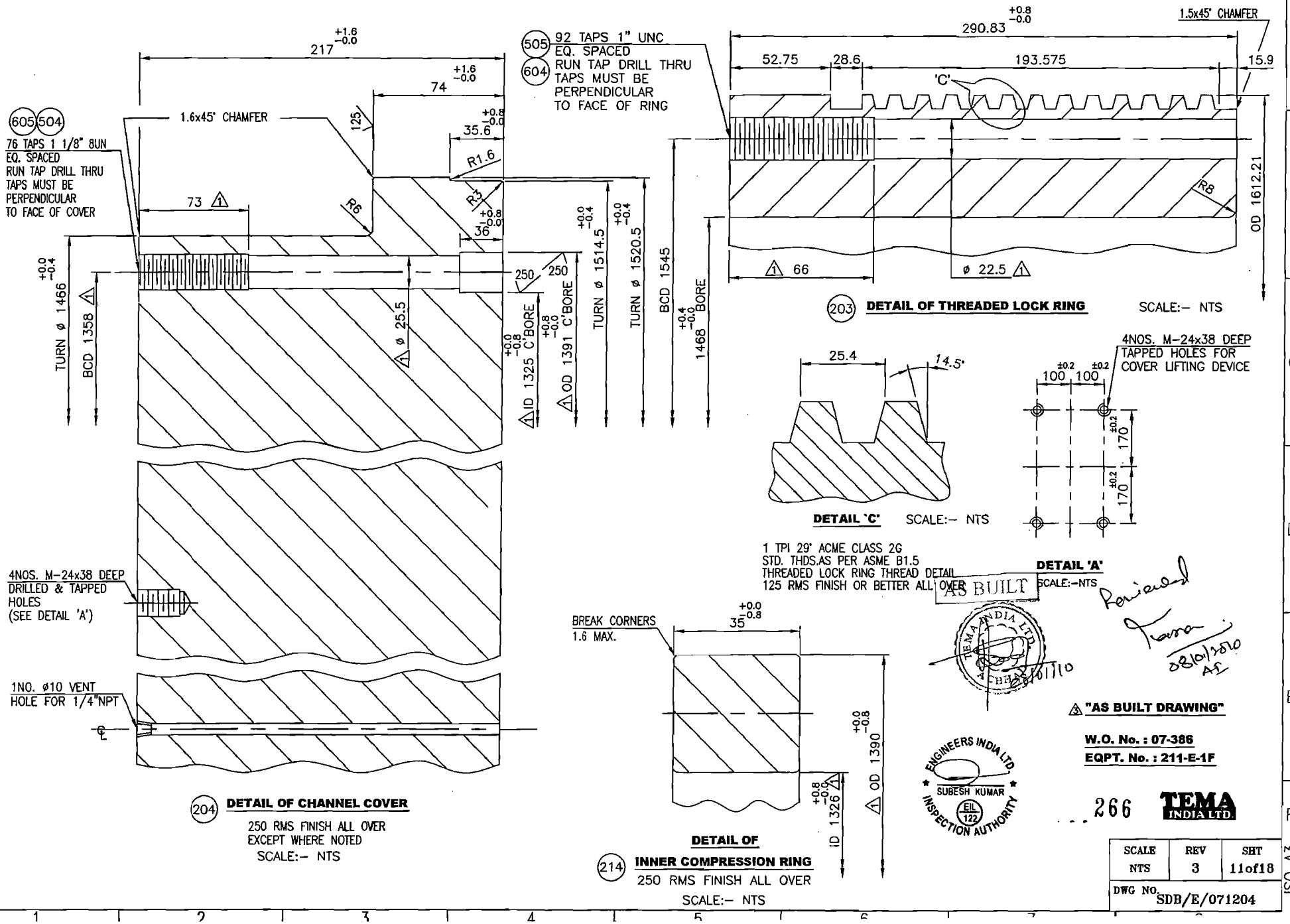
DWG NO. SDB/E/071204

ISO A3



(203) **DETAIL OF THREADED LOCK RING** SCALE:− NTS

DETAIL 'C' SCALE:− NTS

DETAIL 'A' SCALE:−NTS

(204) **DETAIL OF CHANNEL COVER**

250 RMS FINISH ALL OVER
EXCEPT WHERE NOTED
SCALE:− NTS

DETAIL OF

(214) **INNER COMPRESSION RING**

250 RMS FINISH ALL OVER
SCALE:− NTS

Reviewed
Tara
28/01/2010
AE

⚠ **"AS BUILT DRAWING"**

W.O. No. : 07-386

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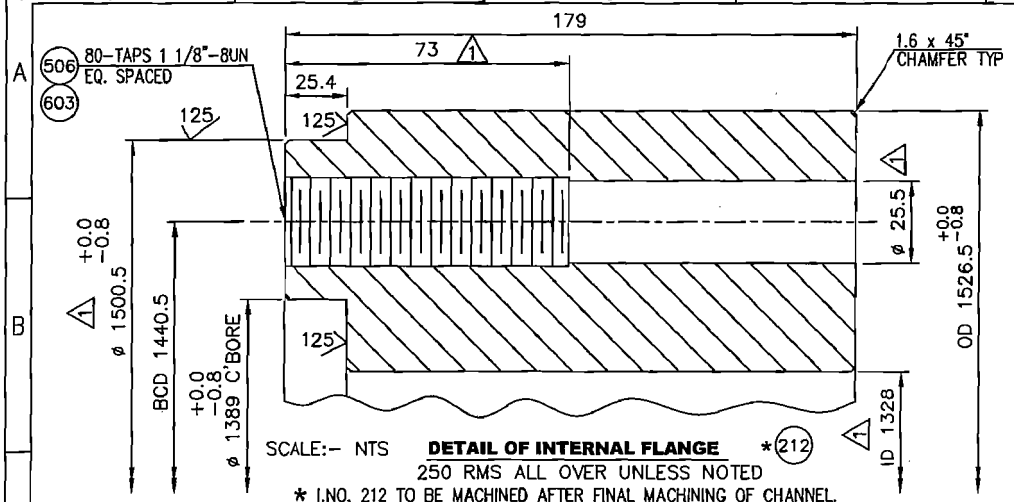
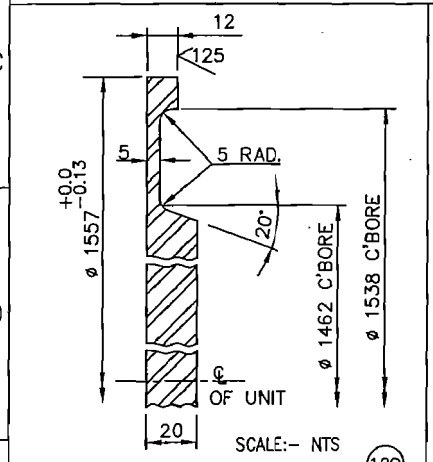
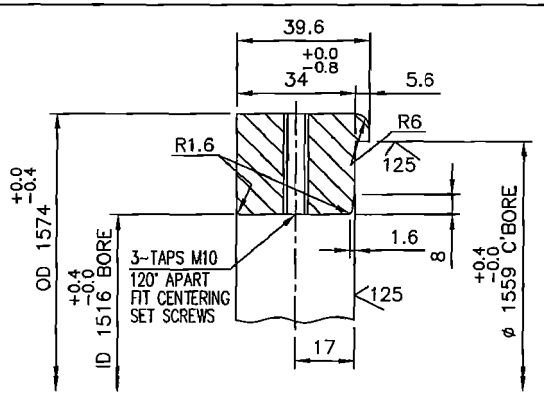
NTS	3	11of18

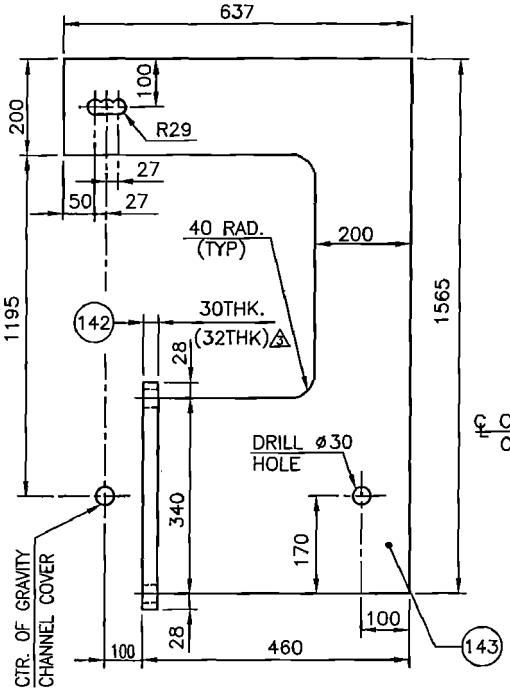
DWG NO. SDB/E/071204

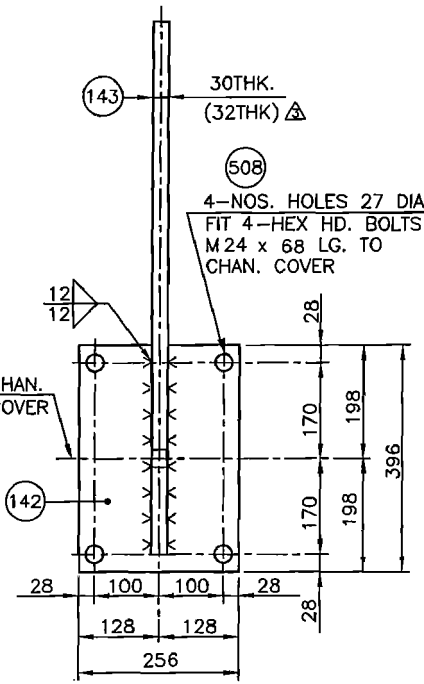
ISO A3

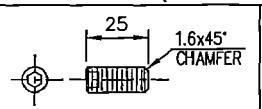




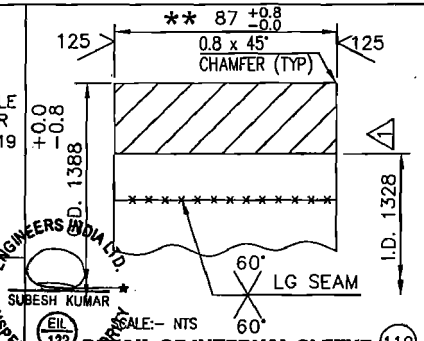


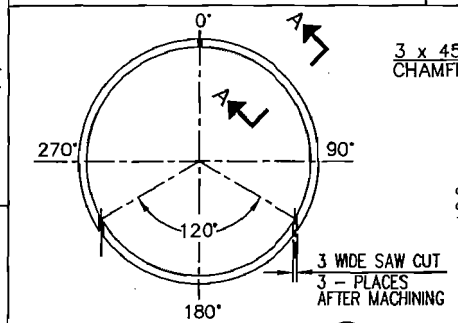


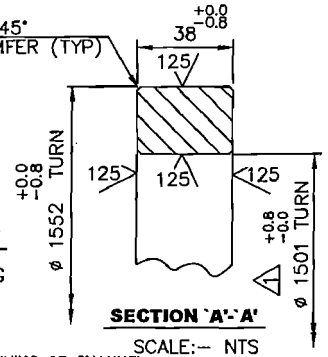




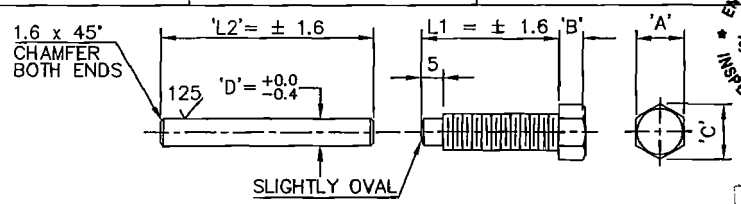
** IMP :- THIS DIMENSION TO BE CHECKED AFTER ASSEMBLY OF TUBE BUNDLE & OTHER INTERNALS PRIOR TO M/CING OF PART NO.119 (PART NO.119 SHALL BE FLUSH WITH PART NO.120 WITHIN $^{+0}_{-0.8}$)







* I.NO. 211 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	146	–
604	PUSH RODS	–	92	–	–	–	22	275	–
605	PUSH RODS	–	76	–	–	–	25	119	–

DETAIL OF SET SCREWS & PUSH RODS

△ "AS BUILT DRAWING"
W.O. No. : 07-386
EQPT. No. : 211-E-1F

AS BUILT

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SCALE	REV	SHT
NTS	3	12of18

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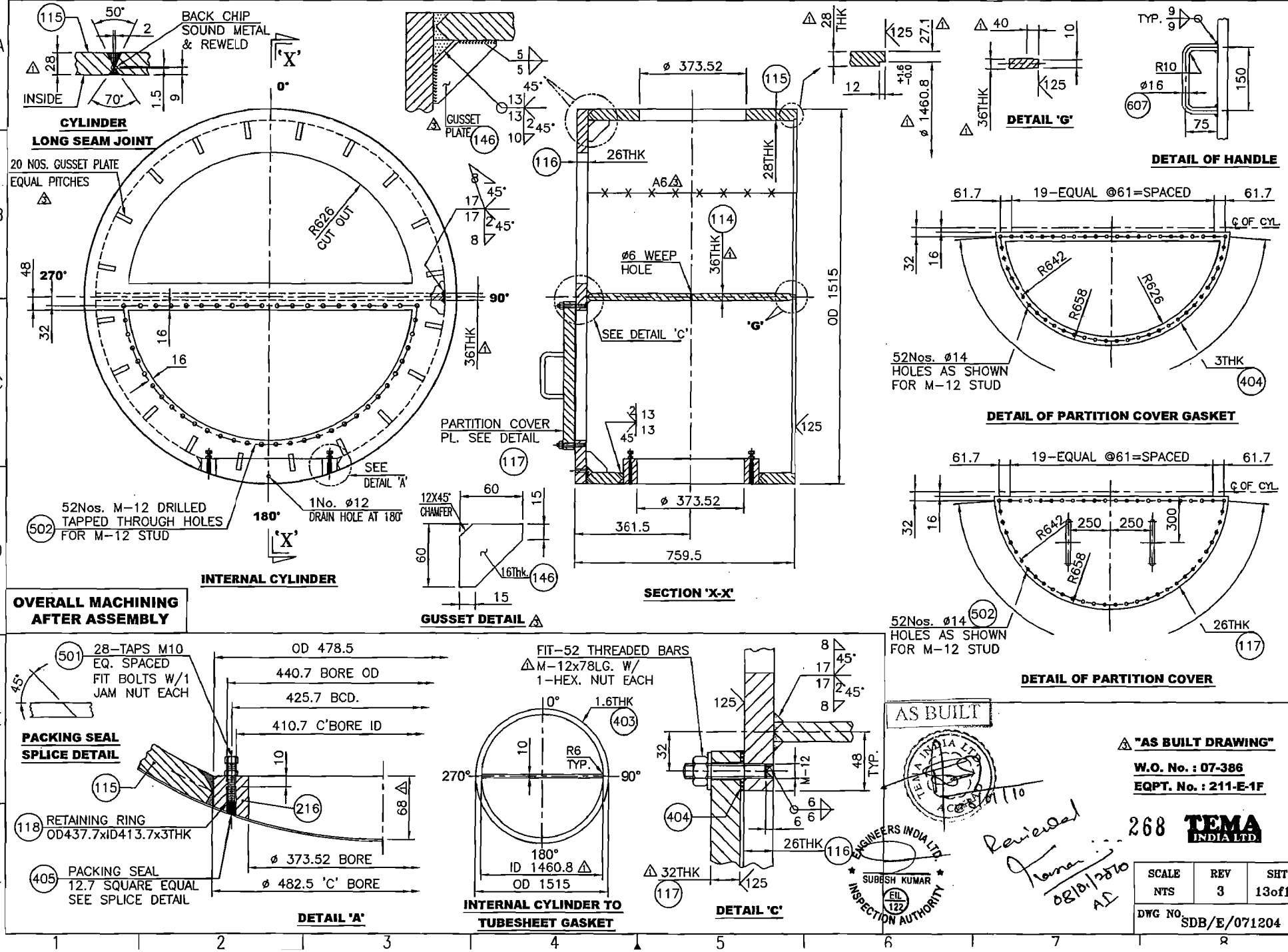
ENGINEERS INDIA LTD. SUBESH KUMAR INSPECTION AUTHORITY EIL 122


CYLINDER LONG SEAM JOINT
BACK CHIP SOUND METAL & REWELD
INSIDE
20 NOS. GUSSET PLATE EQUAL PITCHES
R626 CUT OUT
52Nos. M-12 DRILLED TAPPED THROUGH HOLES FOR M-12 STUD
1No. ø12 DRAIN HOLE AT 180°
SEE DETAIL 'A'
INTERNAL CYLINDER
GUSSET PLATE
GUSSET DETAIL
SECTION 'X-X'
ø6 WEEP HOLE
SEE DETAIL 'C'
PARTITION COVER PL. SEE DETAIL
OD 1515
ø 373.52
361.5
759.5
DETAIL 'G'
DETAIL OF HANDLE
DETAIL OF PARTITION COVER GASKET
52Nos. ø14 HOLES AS SHOWN FOR M-12 STUD
DETAIL OF PARTITION COVER
OVERALL MACHINING AFTER ASSEMBLY
28-TAPS M10 EQ. SPACED FIT BOLTS W/1 JAM NUT EACH
PACKING SEAL SPLICE DETAIL
RETAINING RING OD437.7xID413.7x3THK
PACKING SEAL 12.7 SQUARE EQUAL SEE SPLICE DETAIL
OD 478.5
440.7 BORE OD
425.7 BCD.
410.7 C'BORE ID
ø 373.52 BORE
ø 482.5 'C' BORE
DETAIL 'A'
FIT-52 THREADED BARS M-12x78LG. W/ 1-HEX. NUT EACH
INTERNAL CYLINDER TO TUBESHEET GASKET
DETAIL 'C'
AS BUILT
"AS BUILT DRAWING"
W.O. No. : 07-386
EQPT. No. : 211-E-1F
TEMA INDIA LTD.
ENGINEERS INDIA LTD. SUBESH KUMAR INSPECTION AUTHORITY
Revised
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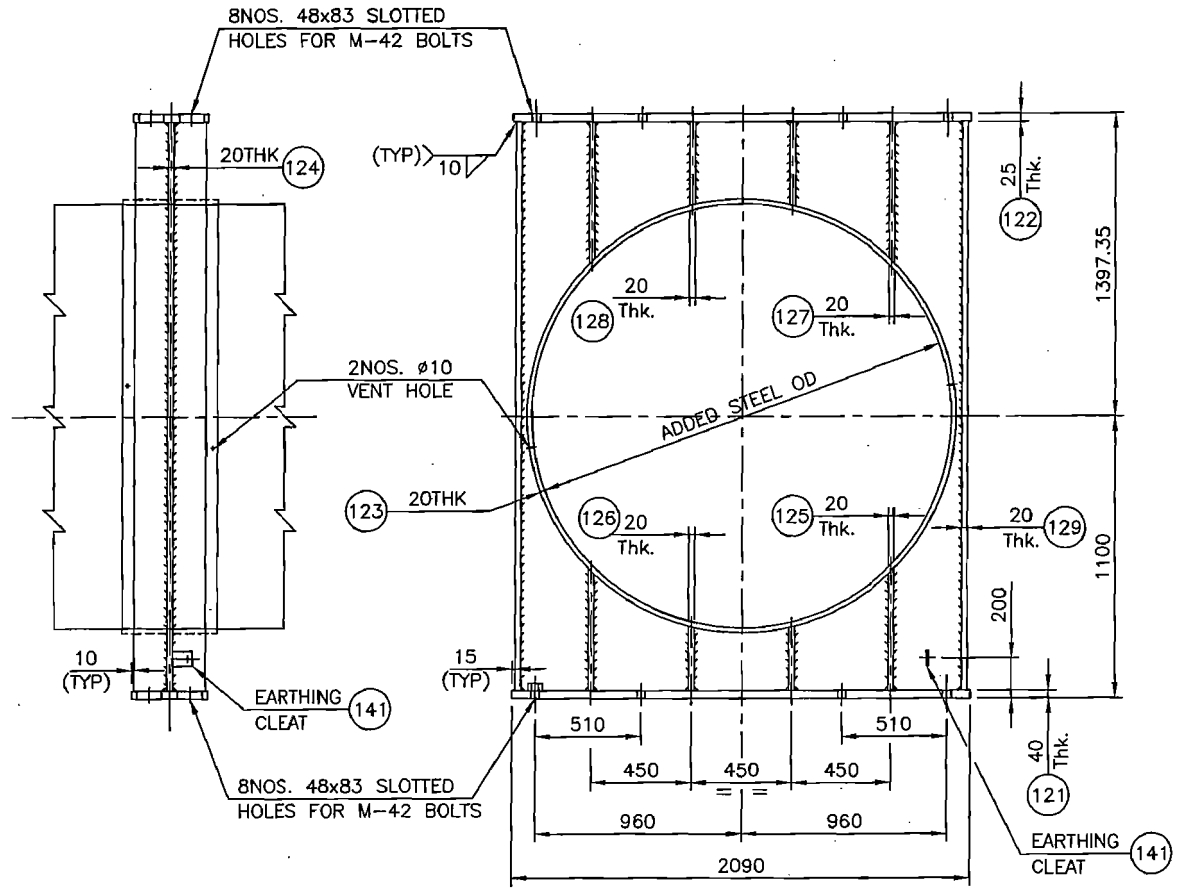
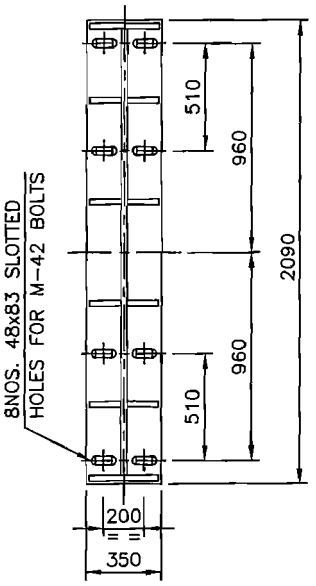
DWG NO SDB/E/071204
ISO A3

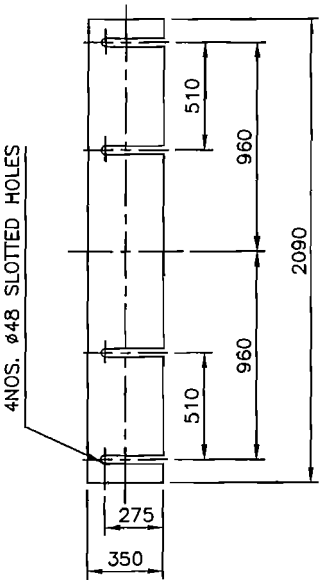


DETAIL OF SADDLE SUPPORT FOR CHANNEL SIDE SCALE:- NTS

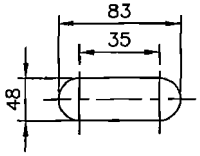
NOTE :-
ALL FILLETS ARE 14 mm.



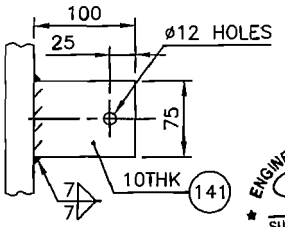
DETAIL OF BASE PLATE (121) (122)



DETAIL OF SHIM PLATE (139)



DETAIL OF SLOTTED HOLE
SCALE:- NTS



DETAIL OF EARTHING CLEAT
SCALE:- NTS

AS BUILT

TEMA INDIA LTD. ACHHEJA 08/10/10

Reviewed
08/10/2010
AE

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

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SCALE	REV	SHT
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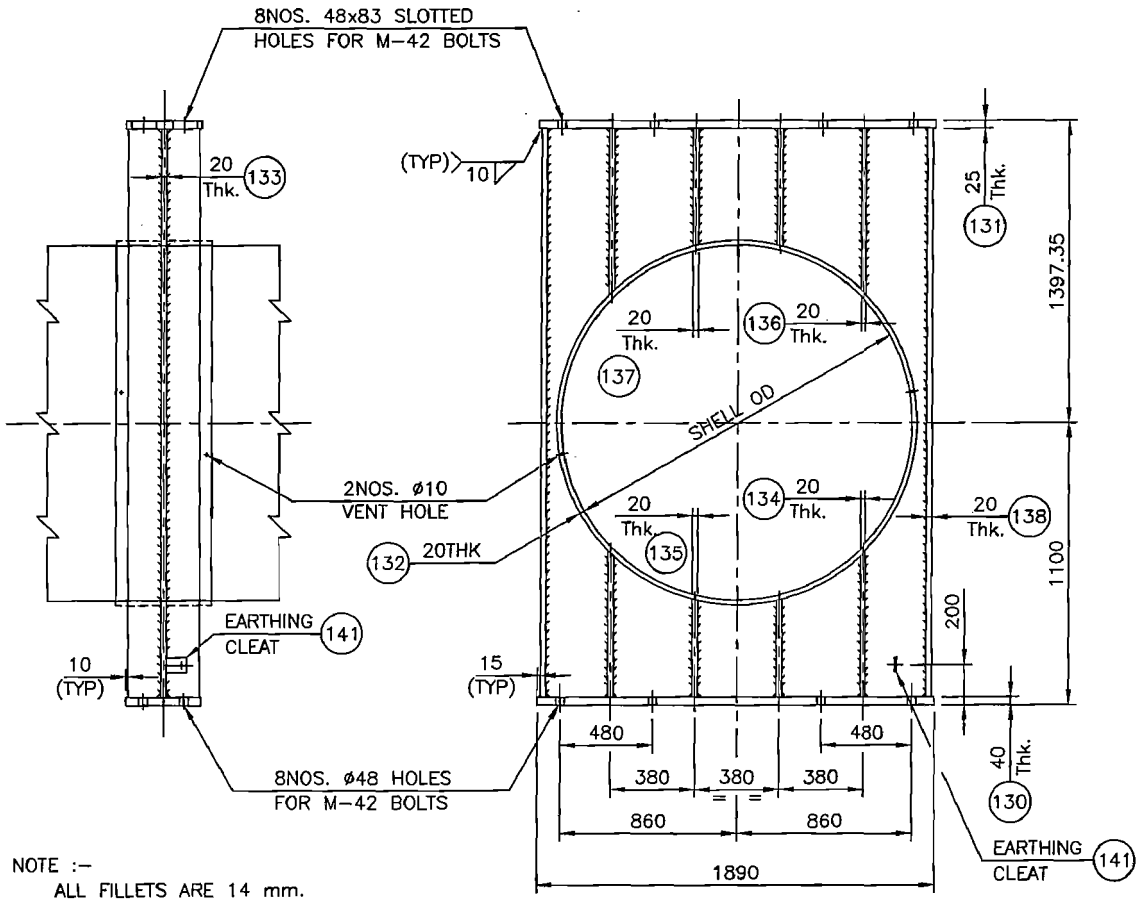
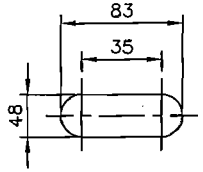
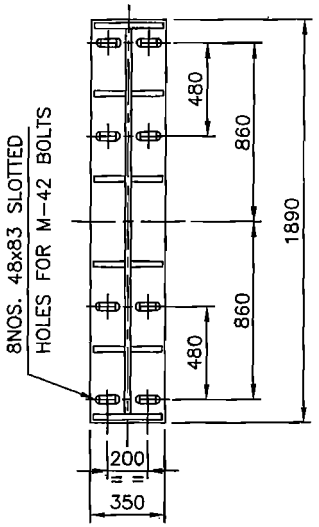


NOTE :-
ALL FILLETS ARE 14 mm.

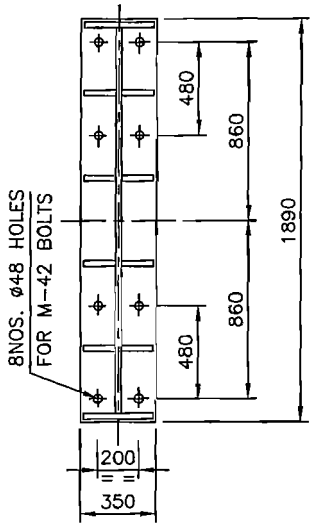
DETAIL OF SADDLE SUPPORT FOR SHELL SIDE SCALE:- NTS



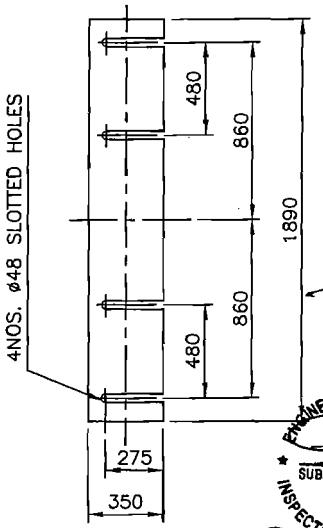
DETAIL OF SLOTTED HOLE
SCALE:- NTS



(131) **DETAIL OF BASE PLATE FOR SLIDING SADDLE**



DETAIL OF BASE PLATE FOR FIXED SADDLE (130)



DETAIL OF SHIM PLATE (140)

AS BUILT

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08/12/10

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⚠ "AS BUILT DRAWING"

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

SCALE	REV	SHT
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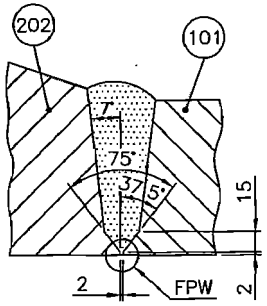
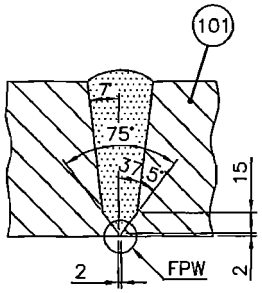
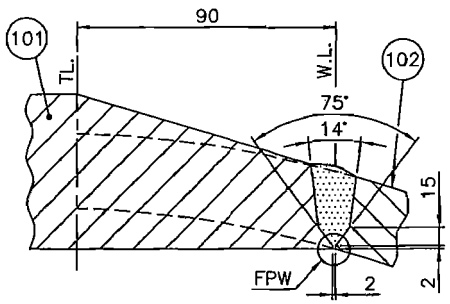


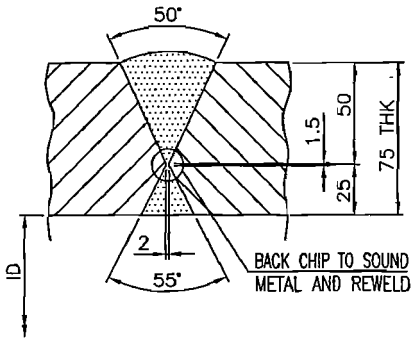
CHANNEL TO SHELL C/S WELD DETAIL



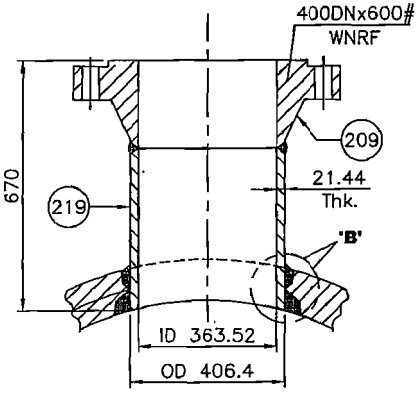
C/S WELD DETAIL FOR MAIN SHELL



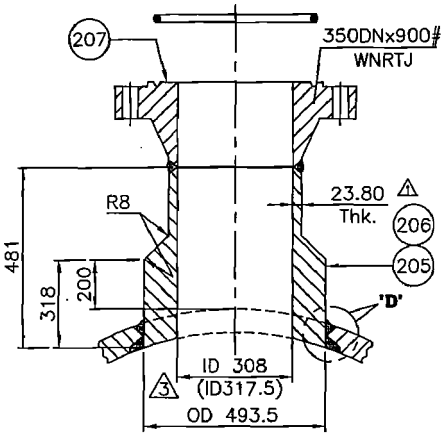
WELD DETAIL OF MAIN SHELL TO HEMISPHERICAL HEAD



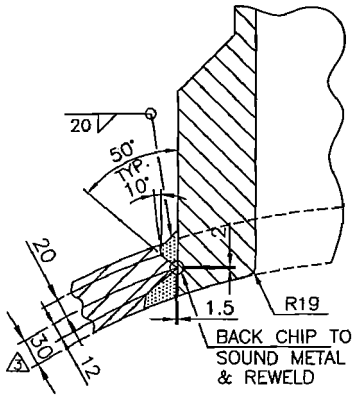
L/S WELD DETAIL FOR MAIN SHELL



DETAIL OF NOZ. T1B & T2B



DETAIL OF NOZ. S1B & S2B



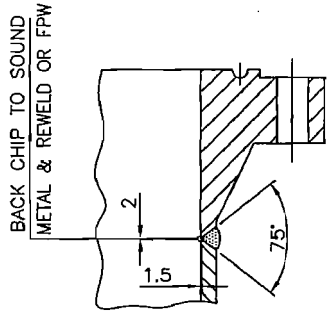
DETAIL 'D' FOR NOZ. S1B & S2B

AS BUILT

TEMA INDIA LTD. CHENNAI

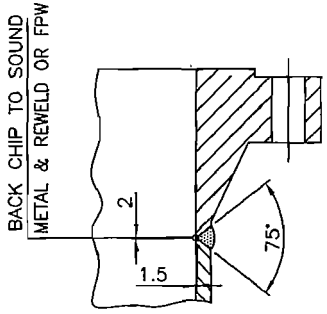
28/01/2010

AE



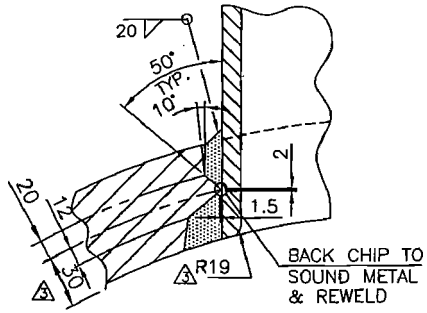
FOR S1B & S2B

TYP. WNRTJ FLG. TO NOZZ. NECK WELD DETAIL



FOR T1B & T2B

TYP. WNRF FLG. TO NOZZ. NECK WELD DETAIL



DETAIL 'B' FOR NOZ. T1B & T2B

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SCALE	REV	SHT
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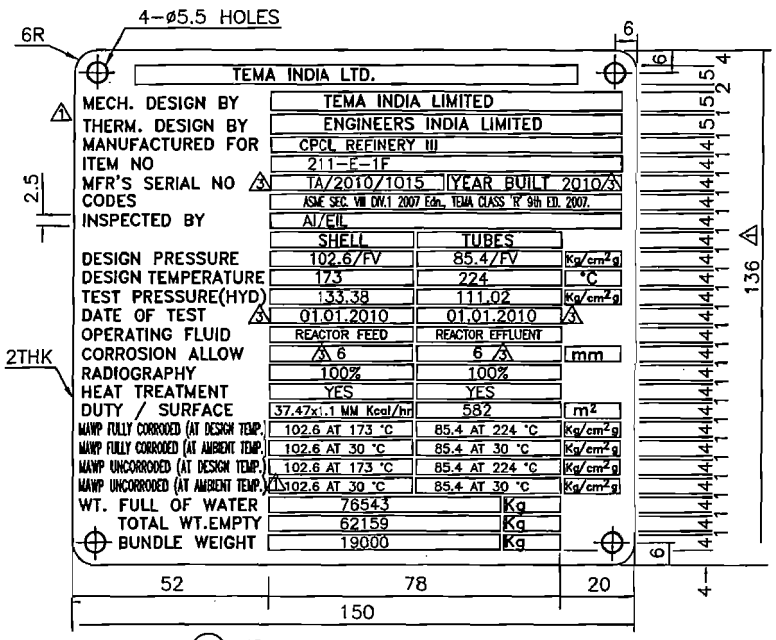
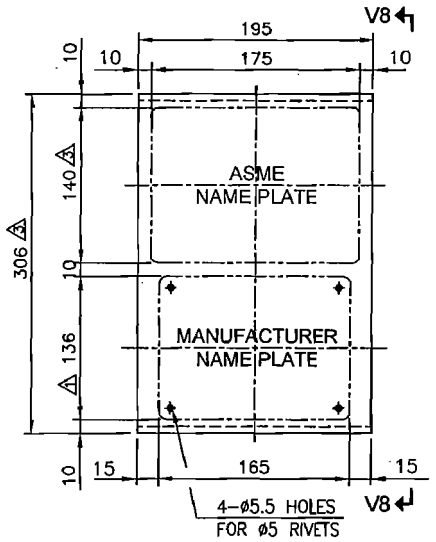
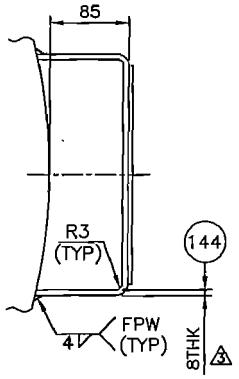


NOTES:- (608) **NAME PLATE** ⚠3

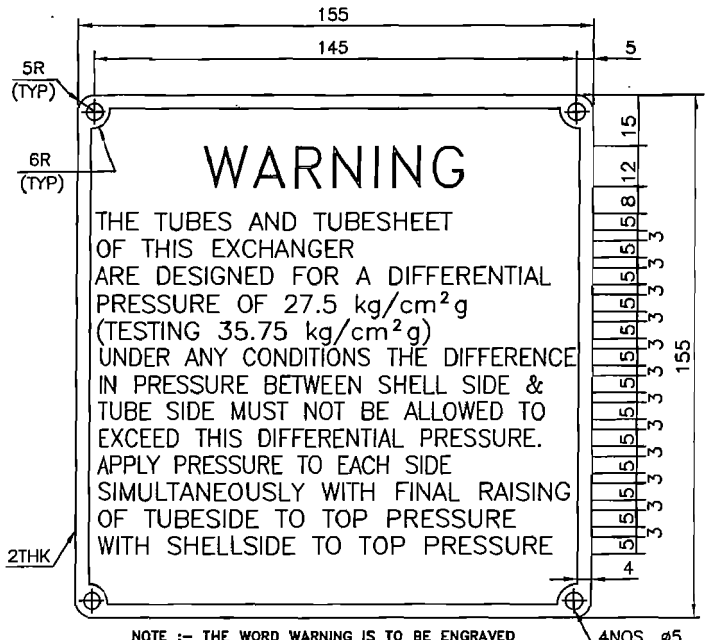
1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. ALL LETTERS AND LETTER BLOCKS SHALL BE ENGRAVED IN BLACK.
3. NAME PLATE SHALL BE RIVETED WITH ø5 ALUMINIUM RIVETS AND TACK WELDED TO BRACKET ON ALL FOUR SIDE.
4. NAME PLATE SHALL BE OF AISI 304 OF 2THK.



DETAIL OF NAME PLATE BRACKET

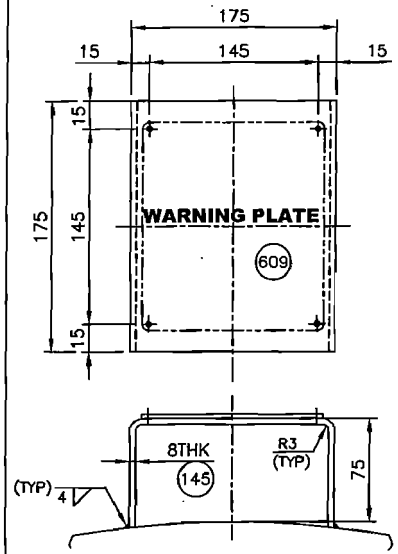


VIEW "V8-V8"



NOTE :- THE WORD WARNING IS TO BE ENGRAVED 1 WIDE x 1.5 DEEP AND FILLED WITH ⚠2 RED PAINT

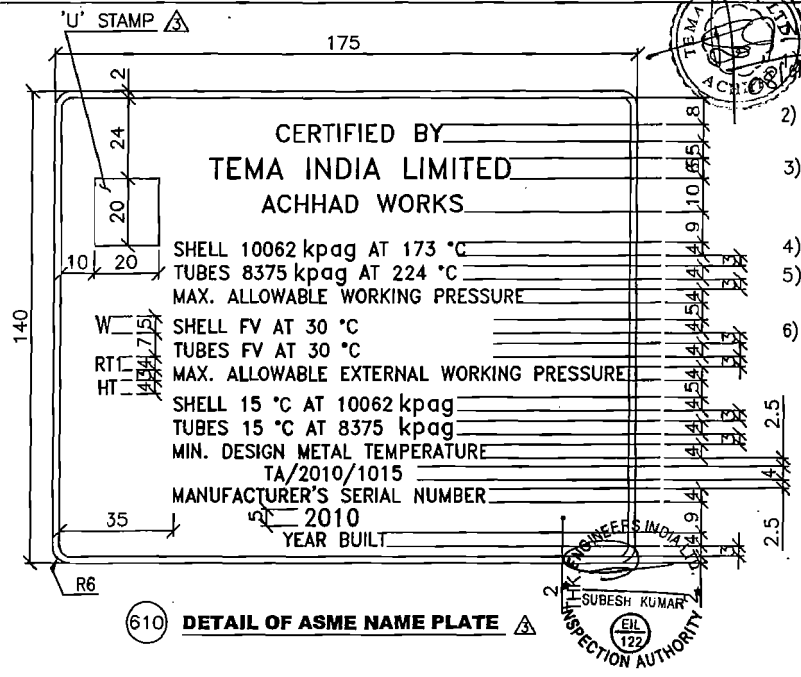
DETAIL OF WARNING PLATE (609)



DETAIL OF WARNING PLATE BRACKET

AS BUILT

Reviewed
08/04/2010



(610) **DETAIL OF ASME NAME PLATE** ⚠3

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

⚠3 **"AS BUILT DRAWING"**

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SCALE	REV	SHT
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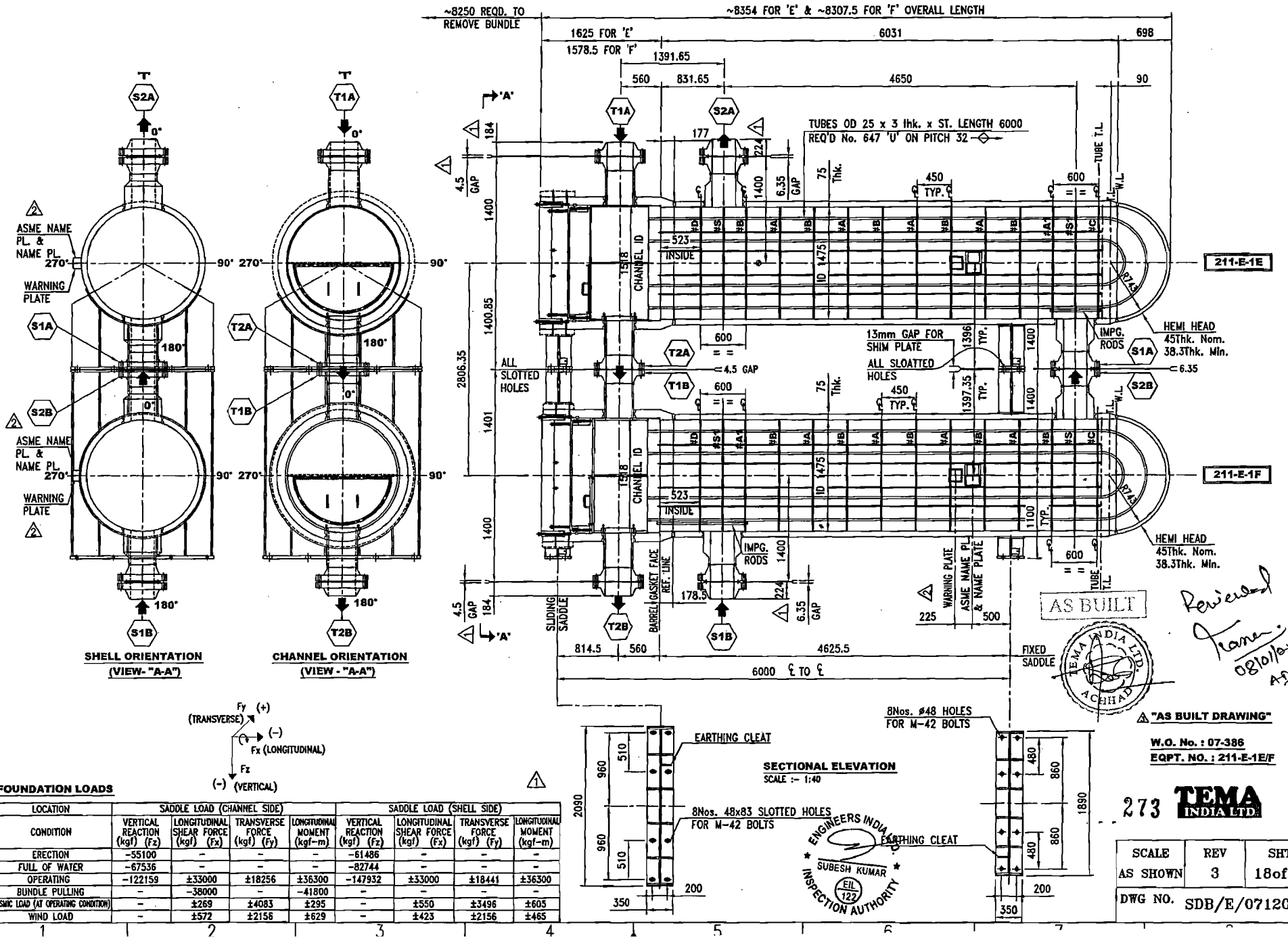

FOUNDATION LOADS

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	-55100	-	-	-	-61486	-	-	-
FULL OF WATER	-67536	-	-	-	-82744	-	-	-
OPERATING	-122159	±33000	±18256	±36300	-147932	±33000	±18441	±36300
BUNDLE PULLING	-	-38000	-	-41800	-	-	-	-
SEISMIC LOAD (AT OPERATING CONDITION)	-	±269	±4083	±295	-	±550	±3496	±605
WIND LOAD	-	±572	±2158	±629	-	±423	±2156	±465

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