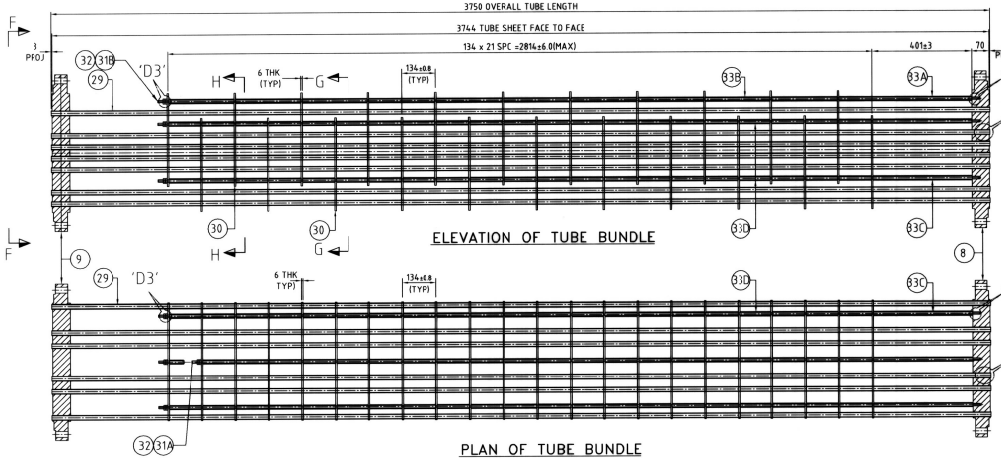
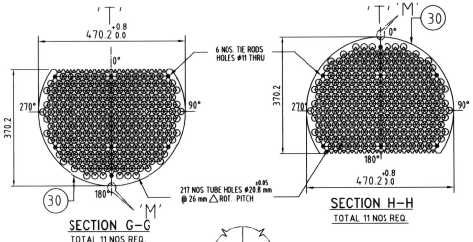
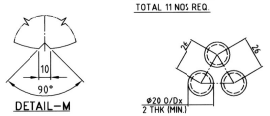
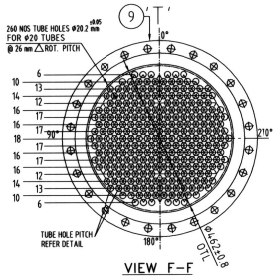
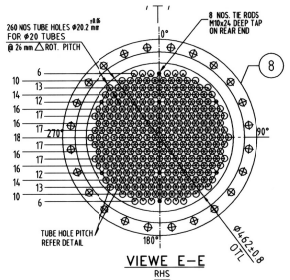










TORQUE TABLE			
SIZE / TQ	INITIAL TQ. (N-m)	INTERMEDIATE TQ. (N-m)	FINAL TQ. (N-m)
M20 FASTENERS	63	111	159
M14 FASTENERS	16	27	39

7.0 TUBE TO TUBESHEET EXPANDING

7.1 AFTER THE ALL TESTS HAVE BEEN SUCCESSFULLY COMPLETED & LEAKING WELDS (IF ANY) REPAIRED, THE TUBES SHALL BE "CONTACT EXPANDED "WITH A PARALLEL TYPE EXPANDER.

7.2 CONTACT EXPANDING SHALL BEGIN 12mm FROM THE TUBESHEET FACE & EXTEND TO 3mm FROM THE BACK FACE.

7.3 CONTACT EXPANSION SHALL HAVE 3-5% THINNING.

8.0 NON-DESTRUCTIVE TESTS

8.1 SPOT RADIOGRAPHY: 5% OF THE TOTAL WELDED LENGTH MUST BE RADIOGRAPHED. FUTHER, ALL 'T' JOINTS MUST BE RADIOGRAPHED & ATLEAST ONE SHOT MUST BE TAKEN ON EACH LONGITUDINA. & CIRCUMFERENTIAL SEAM.

8.2 IF RADIOGRAPHY IS BEING SUBSTITUTED BY UT FOR THE FINAL CLOSING SEAM AS PERMITTED BY CODE, MP SHALL BE CARRIED OUT IN ADDITION TO UT.

8.3 ALL NOZZLES FABRICATED OUT OF PLATE SHALL BE 100% RADIOGRAPHY.

8.4 ALL NOZZLE TO SHELL WELDS & UNHUBBED TUBESHEET TO SHELL WELDS SHALL BE DP or MP CHECKED AT THE ROOT RUN & FINAL WELD.

8.5 ALL ATTACHMENT WELDS SHALL BE EITHER DP or MP TESTED.

9.0 HYDROTEST

9.1 HYDROTEST TO BE DONE IN HORIZONTAL POISTION.

9.2 TESTING WATER SHALL BE CLEAN POTABLE WATER & SHALL NOT CONTAIN CHLORIDE MORE THAN 250PPM SEA WATER SHALL NOT BE USED.

9.3 TEST PRESSURES SHALL BE MAINTAINED FOR AT LEAST ONE HOUR.

9.4 SHELL & TUBE SIDES SHALL BE TESTED SEPARATELY, UNLESS OTHERWISE STATED.

9.5 VENT NOZZLE TO BE KEPT OPEN DURING WATER FLLING & DRAINAGE, FOR/AFTER HYDROTEST TO AVOID DAMAGE TO EQUIPMENT.

10.0 PROTECTION & DESPATCH

10.1 EQUIPMENT SHALL BE SHIPPED IN AS HYDROTESTID CONDITION WITHOUT REMOVING GASKETS USED FOR HYDROTEST.GASKETS USED FOR HYDROTEST SHALL BE SAME AS SPECIFIED IN BOM.

10.2 AFTER COMPLETION OF ALL TESTING & INSPECTION, THE INSIDE OF COMPLETE EQUIPMENT SHALL BE THOROUGHLY DRAINED & DRIED OUT SIMULTANEOUSLY ON BOTH SHELL & TUBE SIDE BY PASSING HOT AIR FOR SUFFICIENT TIME UNTIL NO FURTHER NCREASE IN RELATIVE HUMIDITY OF OUTGOING AIR IS OBSERVED.

10.3 ALL NOZZLES WITHOUT BLIND FLANGES SHALL BE PROVIDED WITH STEEL COVERS, TEMPORARY GASKETS & FLANGES.

10.4 EQUIPMENT SHALL BE PURGED & FILLED WITH DRY N2 AT 0.25kg/cm² PROVIDE PRESSURE GUAGE WITH ¾" NON RETURN VALVE TO MONITOR N2 PRESSURE.

10.5 SURFACE FINISH SHALL BE PREPARED TO NEAR WHITE FINISH AS PER SSPC–SP–10 (SA 2 ½ SWEDISH STANDARD (SIS–05–5900)) BY SHOT BLAST CLEANING.

10.6 EXTERNAL SURFACES, EXCEPT GASKET FACES & MACHINED SURFACES SHALL BE PRIMER PAINTED PRIMER SHALL BE INORGANIC ZINC SILICATE (65–75 MICRONS DRY FILM THICKNESS), UNLESS OTHERWISE STATED.

10.7 THE EQUIPMENT ITEM NUMBER, PO NUMBER & OWNER NAME & ADDRESS SHALL BE PAINTED IN BOLD WHITE PAINT LETTERS WRITTEN WITH STENCIL, ON THE EQUIPMENT.

10.8 SPARES SHALL BE DESPATCHED SEPARATELY IN A BOX & MARKED WITH PO NUMBER, ITEM NUMBER & OWNER'S NAME & ADDRESS.

10.9 SLIDING END OF EXCHANGERS SHALL BE PAINTED AS "CAUTION –SLIDING END" IN BLACK ON THE PRIMER COATING IN THE SHOP

10.10 SUPPLIER SHALL PROVIDE SLING MARK IDENTIFICATION ON EXCHANGER WITH RESPECT TO CENTER OF GRAVITY OF THE EXCHANGER.

11.0 STRESS RELIEVING CYCLE

11.1 STRESS RELIEVING CYCLE FOR CHANNEL DISH END PART NO. 3 & 5) .

A. LOADING TEMP.: 300°C

B. RATE OF HEATING: 56°C–222°C/hr.

C. SOAKING TEMP.: 610°C±10°C

D. SOAKING TIME: 20–25 MINUTES.

E. RATE OF COOLING UPTO (300°C): 56–278°C/hr

F. MEDIUM OF COOLING (+300°C): AIR

NOTES:

1.0 PROCESS

1.1 DESIGN FOR SHELL & TUBE AVERAGE METAL TEMPERATURE OF
i) 39° & 43 °C RESPECTIVELY FOR NORMAL OPERATION.
ii) 33° & 33 °C RESPECTIVELY FOR SHELL SIDE START–UP OPERATION.
iii) 33° & 104 °C RESPECTIVELY FOR LOSS OF COOLING.

2.0 GENERAL

2.1 ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE STATED.
2.2 ALL BOLT HOLES TO STRADDLE BOTH NATURAL CENTRELINES.
2.3 FOR HEAT EXCHANGER TOLERANCES REFER EIL STANDARD 7–15–0019, REV3 or TEMA, IF NOT SPECIFIED IN EIL STANDARD STRINGENT OR BOTH SHALL GOVERN.
2.4 THE REQUIREMENT OF PARAGRAPH UCS–66 OF ASME SEC VIII DIV 1 SHALL APPLY FOR ALL CARBON STEEL MATERIALS.
2.5 ALL MATERIALS FOR PRESSURE PARTS & PARTS WELDED TO PRESSURE PARTS INCLUDING MATERIALS IN THE SCOPE OF SUB–SUPPLIERS SHALL BE ACCOMPANIED WITH MILL TEST CERTIFICATES DULY CERTIFIED BY A REPUTED THIRD PARTY INSPECTION AGENCY.
2.6 INDICATED THICKNESS ARE MINIMUM AFTER CONSTRUCTION.
2.7 DISH THICKNESS SPECIFIED AS MINIMUM THICKNESS AFTER FORMING.
2.8 ROLLING FOR BENDING & FORMING OF PLATES SHALL BE IN THE LONGITUDINAL DIRECTION OF THE PLATES. THIS DIRECTION SHALL BE CLEARLY MARKED ON THE PLATES.
2.9 "T" WHEREVER INDICATED ON DRAWNGS, DENOTES MATCH MARK FOR ASSEMBLY & SHALL BE PUNCHED ON ALL MATING PARTS.
2.10 FOR CARBON STEEL PRESSURE PAR'S THE ELECTRODES SHALL BE OF LOW HYDROGEN TYPE.
2.11 ALL WELDS SHALL BE FULL PENETRATION WITH BACK CHIPPED TO SOUND METAL & REWELDED FROM THE OTHERSIDE, UNLESS OTHERWISE SHEWN. FOR THOSE JOINTS WHICH ARE INACCESSIBLE FOR BACK CHIPPING, ROOT RUN SHALL BE CARRIED OUT WITH GTAW PROCESS.
2.12 DURING WELDING OF NOZZLES IN EXHANGER, IF BACK GOUGING IS REQUIRED, GAUGING ELECTRODES BE USED INSTEAD OF GRINDING TO AVOID / MINIMIZE THE REDUCTION IN THE THICKNESS OF NOZZLE PIPE.
2.13 ALL NOZZLES 2" NB & BELOW, SHALL HAVE TWO STIFFENERS (30mmx 6mm) AT RIGHT ANGLES.
2.14 ALL REINFORCING PADS SHALL BE PROVIDED WITH TWO 1/8" (3mm) NPT TAPPED HOLES LOCATED 180° APART FOR AIR SOAP SOLUTION TEST WITH A PRESSURE OF 1.25kg/cm² (g)
2.15 ALL THE REINFORCEMENT PAD TELL–TALE HOLES SHOULD BE PLUGGED WITH HARD GREASE. NO GRUB SCREWS TO BE PROVIDED.
2.16 FLANGES UPTO 24" NB SHALL CONFORM TO ASME B16.5–2003 & ABOVE 24" NB SHALL CONFORM TO ASME B16.47–1996 SERIES B.
2.17 GASKET SEATING SURFACE OF FLANGES (INCLUDING GIRTH FLANGE) SHALL SMOOTH FINISH TO 125AARH.
2.18 NO DISTORTION WHATSOEVER SHAL. BE PERMITTED ON THE GASKET SEATING SURFACES DUE TO TUBE TO TUBESHEET WELDING, SHELL TO TUBESHEET WELDING, PWHT ETC. IF DISTORTED, THE SAME SHALL BE MACHINED SUBSEQUENTLY.
2.19 ALL EDGES & CORNERS INCLUDING BAFFLE HOLES SHALL BE DEBURRED (or ROUNDED, IF SHOWN).
2.20 ALL OVER "Q" FINISH REQUIRED UNLESS OTHERWISE STATED. PARTS SUBJECTED TO UT SHALL HAVE MINIMUM FINISH OF 6 MICRONS.
2.21 ALL MACHINED SURFACES SHALL BE SUITABLY PROTECTED WITH RUST PREVENTIVE COATING AFTER MACHINING.
2.22 METRIC BOLTING & THREADING SHALL CONFORM TO ISO–R261 (EXCEPT FOR SIZE M24 & ABOVE), WHERE IT SHALL HAVE 3mm PITCH & SHALL BE THREADED FULL LENGTH.
2.23 SIZE OF THE STUDS & NUTS SHALL BE CLEARLY PUNCH MARKED ON ONE OF THE FACES.
2.24 THREADS ON EXTERNAL BOLTING, PLUGS ETC. SHALL BE LUBRICATED WITH GRAPHITE GREASE FOR WORKING TEMPERATURE UPTO 200°, & WITH MOLYDENUM DISULPHIDE FOR HIGHER TEMPERATURES.
2.25 LIFTING LUGS ARE DESIGNED FOR LIFTING IN EMPTY CONDITION ONLY.
2.26 ALL EXCHANGERS TO BE FITTED WITH 2 EARTHING LUGS. FOR HORIZONTAL EXCHANGER ON TWO SADDLE SUPPORTS ONE ON CENTRAL WEB. EARTHING LUGS SHALL NOT BE PAINTED OR GALVANISED.
2.27 ALL REQUIREMENTS OF THE PR SHALL COMPLY WITH , UNLESS OTHERWISE AGREED BETWEEN THE EIL & CICB–CHEMICON, WITHOUT ANY COST & DELIVARY IMPLICATIONS.

3.0 MATERIALS

3.1 PLATES

3.11 CARBON CONTENT SHALL NOT EXCIED 0.23%.
3.12 PLATES USED FOR PRESSURE PARTS & WELDED TO PRESSURE PARTS SHALL BE SUPPLIED IN NORMALISED CONDITION & SHALL CONFORM TO SPECIFICATION SA– 20.

3.2 PIPES

3.21 PIPES SHALL BE SEAMLESS & SIZES ABOVE 1 ½ SHALL BE HOT FINISHED.
3.22 DIMENSIONS & TOLERANCES SHALL BE IN ACCORDANCE WITH ASME B36.10 or ASME B36.19, AS APPLICABLE.

3.3 FORGINGS

3.31 NON–STANDARD FORGINGS (SA–216, SA–350 LF2 CL1 etc.) SHALL BE NORMALISED & TEMPERED.
3.32 FORGINGS MANUFACTURED TO SA 105 & SA 266 ABOVE 75mm THICKNESS, ALL TUBESHEET FORGINGS , & ALL FORGINGS OF OTHER MATERIALS, EXCEPT FOR THE STANDARD NOZZLE FLANGES UPTO 8 NB & SMALL FORGINGS (OF COUPLINGS, "LUGS & EYE BOLTS) SHALL BE 100% UT AS PER SA–388 (ACCEPTANCE CRITERIA SHALL BE AS PER PARA AM 203.2 OF ASME SEC VIII DIV 2).

3.4 TUBES

3.41 TUBES SHALL BE SEAMLESS, COLE DRAWN & ANNEALED CONDITION.
3.42 PRODUCT ANALYSIS OF TUBES SHALL BE CARRIED OUT & REPORTED IN THE MATERIAL TEST CERTIFICATES.
3.43 MAX. YIELD STRENGTH & HARDNESS OF TUBES ARE SPECIFIED SUCH AS TO BE LOWER THAN THOSE OF TUBESHEET, IN ORDER TO ACHIEVE A SOUND EXPANDED TUBE TO TUBESHEET JOINT, COMPLYING WITH CODE REQUIREMENTS.
3.44 "AIR UNDER WATER" or HYDROTESTED (HYDRO TEST PRESSURE OF TUBES SHALL BE HIGHER OF TUBE SIDE TEST PRESSURE or AS REQUIRED BY CODE) SHALL BE CARRIED OUT FOR ALL TUBES.

3.5 NON–PRESSURE PARTS

3.51 CS PLATES SHALL BE MIN. IS 2062 or SA 283 Gr. C or EQUIVALENT. PIPES SHALL BE TO IS 1239 or SA 53 or EQUIVALENT.

3.6 GASKET

3.61 THE HARDNESS OF THE METAL FOR SOLID GASKETS SHALL BE MIN. 15 BHN LOWER THAN THAT OF THE MATERIAL OF THE FLANGE GASKET SEATING SURFACE & IN ANY CASE NOT TO EXCEED 110BHN.
3.62 FILLER IN METAL JACKETTED GASKETS IS ARAMIDE FIBRE.
3.63 ALL GASKETS SHALL BE MADE IN ONE CONTINUOUS PIECE ALL AROUND INCLUDING THE PASS PARTITION RIBS (IF ANY) & i.e. MUST BE CUT FROM ONE SHEET.
3.64 CORNER RADII OF GASKETS TO BE 10mm.
3.65 2mm THICK NON–ASBESTOS (BS7531 Gr. X) RING GASKET FOR SHELLNOZZLES. DIMENSIONS–ASME B16.21.
3.66 SPIRAL WOUND GASKETS FOR CHANNEL NOZZLES SHALL BE 4.5 THICK WITH GRAFIL FILLER & 3.2 THICK CS OUTER RING. DIMENSIONS AS PER ASME B16.20

4.0 PREPARATION OF TUBES & TUBESHEET

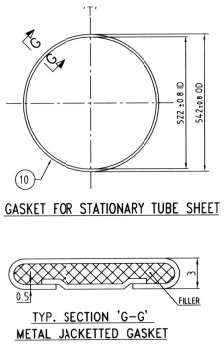
4.1 TUBESHEET FACES SHALL BE FLAT WITHIN +1.5mm (CAMBER).
4.2 TUBE HOLES SHALL BE FREE FROM ANY BURNS AND THE EDGE OF TUBE HOLES SHALL BE CHAMFERED (1mm x 45°) or RADIUSED (R=1mm)
4.3 TUBE HOLES SHALL HAVE SMOOTH FINISH TO 63 AARH.
4.4 PRIOR TO ASSEMBLY, THE TUBESHEET & TUBE ENDS (INSIDE & OUTSIDE FOR A DISTENCE EQUAL TO THE TUBESHEET THICKNESS + 30mm) SHALL BE CLEANED & DEGREASED (FROM SOLVENT, WHICH IS CHLORIDE & SULPHIDE FREE & NON RESUDEFORMING) TO FREE FROM DIRT, GREASE, ETC.).
4.5 TUBES SHALL BE POSITIONED IN THE TUBESHEET BY 30° TAPERED DRIFT PIN.
4.6 BEFORE WELDING TUBE TO TUBESHEET, THE TUBESHEET SHALL BE HEATED TO A TEMPERATURE AS REQUIRED TO REMOVE ANY TRACES OF MOISTURE OR SOLVENT, WHICH MAY REMAIN AFTER THE CLEANING OPERATION.

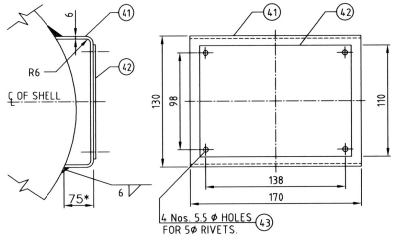
5.0 TUBE TO TUBESHEET WELDING PROCESS

5.1 MANUAL or AUTOMATIC TUNGSTEN INERT GAS SHIELDED ARC (TIG) WELDING SHALL BE USED.
5.2 ALL JOINTS SHALL BE MADE BY USING MINIMUM TWO WELD PASSES (1st PASS SHOULD BE WITHOUT FILLER WIRE TO ENSURE ROOT FUSION & 2nd or FINAL PASS SHALL BE WITH FILLER WIRE).
5.3 WELDS SHALL BE SUITABLY FINISHED & ANY SPILLAGE or SPATTER ON TUBESHEET REMOVED. SPILLAGE OF WELD METAL INTO THE BORES OF TUBE IS NOT PERMITTED.

6.0 EXAMINATION OF WELD JOINTS (TUBE TO TUBESHEET)

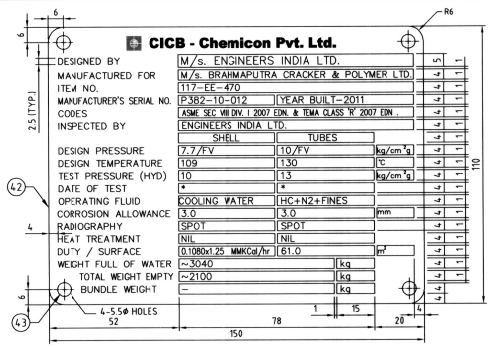
6.1 JOINTS SHALL BE SUBJECTED TO PNEUMATIC AIR–SOAP SOLUTION TEST OF 1.25 kg/cm²(g).
6.2 AFTER COMPLETION OF WELDING, THE TUBESHEET FACE, THE WELDS & INTERNAL TUBE SURFACES TO A DISTANCE OF 25mm BEYOND THE FUSION LINE MUST BE CLEANED THOROUGHLY BY WIRE BRUSH & SOLVENT'S TO REMOVE ALL WELD SLAG, RUST, SCALE, ETC., & EXAMINED CAREFULLY FOR SURFACE DEFECTS.
6.3 AFTER THE VISUAL INSPECTION, A LIQUID PENETRANT EXAMINATION IN ACCORDANCE WITH ASME SEC VIII DIV 1, APPENDIX–8 & SEC V, ARTILLE 6 SHALL BE DONE.
6.4 TUBE TO TUBESHEET JOINTS SHALL BE COMPLIED WITH REQUIREMENTS OF EIL SPEC. 6–15–0003, R3 (STANDARD SPECIFICATION FOR WELDED TUBE TO TUBESHEET JOINT).





* H=75 or INSULATION THICK + 10 WHICHEVER IS GREATER.

NAME PLATE BRACKET DETAILS



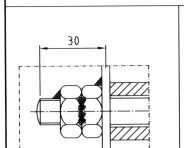
MANUFACTURER NAME PLATE

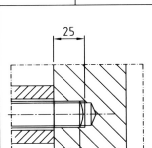
NOTES:

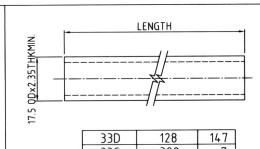
1. ALL LETTERS & LETTER BLOCKS SHALL BE ENGRAVED IN BLACK.
2. NAME PLATE SHALL BE RIVETED WITH 5Ø ALUMINIUM RIVETS & SHALL BE TACK WELDED TO BRACKET ON ALL FOUR SIDES.
3. MATERIAL
   NAME PLATE: STAINLESS STEEL 18:8.
   NAME PLATE BRACKET: SAME AS EXCHANGER SHELL.
4. * DATE OF TEST AS PER ACTUAL

PART No.	DESCRIPTION	QTY.	MATERIAL	SIZE
46	STD. GASKET – NS, N6, N9 & N10	4+16	SS 316 SP. WD	15" x 150 # x 4.5 THK, CONFIRM TO ASME B 16.20
45	JACK SCREWS	3	193 Gr. B8	M16 x 100 LG, CONFIRM TO ISO–4014–3mm PITCH, REF. DETAIL
44	EARTHING LUG	2	IS:2062 Gr. B	100 x 75 x 10 THK
43	RIVETS FOR NAME PLATE	4	ALUMINIUM	Ø5 x 20 LG.
42	NAME PLATE	1	SA 240 TP304	150 x 110 x 2 THK
41	NAME PLATE BRACKET	1	SA 516 Gr. 60	325 x 130 x 6 THK
40	LIFTING LUG (CHANNEL)	4	SA 516 Gr. 60	75 x 65 x 16 THK, REF. DETAIL
39	RIB PLATE–2	2	IS:2062 Gr. B	75 X 122 x 12 THK

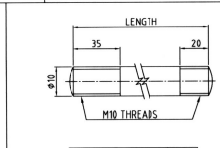
BILL OF MATERIAL (CONTINUATION FROM SHEET 1 OF 2)



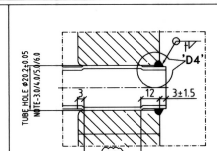


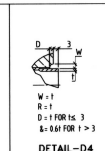


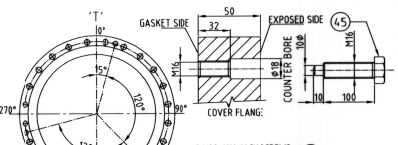
SPACERS			
33D	128	147
33C	398	7
33B	262	20
33A	532	1
PART No.	LENGTH	QTY



TIE–RODS		
31A	3130	1
31B	3265	7
PART No.	LENGTH	QTY







REV	DATE	DESCRIPTION	BY	CHKD	APPD
2	11.07.2011	AS BUILT DIMENSIONS INCORPORTED	DS	ARK/HNM	HVR
1	23.03.2011	INCORPORTED AS PER EIL COMMENTS & REISSUED FOR APPROVAL	HNM	HNM	HVR
0	16.11.2010	ISSUED FOR APPROVAL	ASR	HNM	HVR

REVISION LIST

CICB - Chemicon Pvt. Ltd.
BANGALORE

DRN ASR	CLIENT : M/s. BRAHMAPUTRA CRACKER & POLYMER LIMITED.
DATE 11.11.2010	CONSULTANT : M/s. ENGINEERS INDIA LTD.
CHKD HNM	END USER : M/s. BRAHMAPUTRA CRACKER & POLYMER LIMITED.
DATE 11.11.2010	TITLE : AS–BUILT DRAWING FABRICATION DETAIL OF RECYCLE GAS COOLER
APPD HVR	
DATE 11.11.2010	
SCALE NTS	
DWG. No.: CICB–P382–303	SHEET NO.: 2 OF 3 REV. No.: 02
PROJECT: BCP., LEPETKATA–ASSAM	UNIT: LDPE/HDPE
NO. OF UNITS: ONE	SHELLS / UNIT: ONE
TAG No.: 117–EE–470	
CLIENT'S PR. No.: 6907–117–EE–PR–6055/0174–REV 0, D: 23.07.2010	

THIS DWG IS THE PROPERTY OF CICB ALL USE WITHOUT WRITTEN CONSENT FORBIDDEN.

CICB–CHEMICON JOB No. P382–10–012

MASTER INDEX NO.: 10–537

CADFILE : M:/P382–10–012/DESIGN/DRAWINGS/FABRICATION/CURRENT/CICB–P382–303–0203–R2

A1 (594 x 841)