tkIS India / Vendor

Category Codes (Submission Purpose)

- ☐ 1 For Approval
- ☐ 2 For Review / Comments
- ☐ 3 For Information
- ☐ 4 For Engineering
- ☐ 5 For Enquiry
- ☐ 6 For Order Placement
- ☐ 7 Final & Approved
- ☐ 8 Released for Construction

Acceptance Codes (Approval Codes)

- ☐ 1 Approved
- ☐ 2 Approved for Manufacturing / Fabrication with Comments as marked
- ☐ 3 Not Approved / Resubmit
- ☐ 4 Retained for Information / Records
- ☐ 5 Reviewed
- ☐ 6 Reviewed as Noted / Resubmit

Remarks for AC2 : This marked-up drawings is hereby approved for fabrication / manufacturing and shall be re-sbumitted after revision. This drawing should be revised only to the extent of tkIS India / Owner / Client comments. Any other changes made by you will not be considered unless clearly highlighted in covering letter asking for approval.

This approval / review does not absolve the supplier from the full responsibility for design and fabrication.

Date : ___/___/_____ Name : _____

tkIS India / Owner / Client

Category Codes (Submission Purpose)

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- ☐ 6 Reviewed as Noted / Resubmit

Date : ___/___/_____ Name : _____

Rev	Status	Description	Date	Prepared	Date	Checked	Date	Approved	AC
00		Issued For Enquiry	06.11.2018	SPT	22.11.2018	SKM	23.11.2018	SKM	

Barcode

Category Code

B 66-0215-10730419 EC 000 00 IA 06.12.2018

Plant	Client	Contract Code	Document ID	Contract No.
350 MTPD Caustic Soda Expansion	**PACL**	**PACL- 350 TPD EXPN**	**0215-EQS-07-EC-0001**	**66- 0215-700**

thyssenkrupp

DATA SHEET FOR PLATE HEAT EXCHANGER (CASE 1 FOR 350 TPD Caustic Soda Plant)

Vapour Condenser
Item No. 07E02N

pacl
PACL LIMITED

SN	Rev												
1		Quantity (operation / stand-by)		1				13	Part	Material		Remarks	
1		Arrangement parallel		Series		Stand-by		14	Plates	Titanium Gr.1			
2		Surface area / exchanger (Eff./Total) m2 (Note-1)		*				15	End plate	SA 516 Gr.60/ 70			
3		Number of exchangers per unit		1				16	Frame	SA 516 Gr.60/ 70			
4		Number of plates, assemb. / max		*		*		17	Bolts / Nuts (Fluid 1)	SA 193 GR.B7 / 194 GR. 2H		With cd	
5		Min. plate thickness	mm	0.6				18	Bolts / Nuts (Fluid 2)	SA 193 GR.B7 / 194 GR. 2H		electroplating	
6		Type		Plate Type				19	Gaskets	EPDM			
7		Material (process side)		Titanium Gr.1				20	Nozzle flanges fl.1	*			
8		Model No.		*				21	Nozzle flanges fl.2	*			
9		Supplier		*				22	Nozzle pipe fl.1	Ti Gr. 2 LINED			
10		Weight, delivery	kg	*				23	Nozzle pipe fl.2	AISI 316 LINED			
11		Weight with process fluid	kg	*				24	Flanges acc. to	ASME B16.5, 150#			
12		Weight, water filled	kg	*				25	Design code	ASME SEC-VIII, DIV.1			
26		Remarks:											
27		(*) - Data to be filled by Vendor											
28		INSULATION REQUIRED (Y / N) : N							INSPECTION BY :	CLIENT / tkIS(India)			
29		Note 1 : Heat exchanger is to be designed for 10% excess area over dirty heat transfer coefficient.											
30													
31													

				Fluid 1		Fluid 2	
32							
33		Process fluid		MOIST CHLORINE		COOLING WATER	
34							
35		physical condition , in / out (S)olid, (L)iquid, (V)apour, (G)as		GAS	GAS/LIQUID	LIQUID	LIQUID
36		Class of hazard		Corrosive			
37		pH-value					
38		H2-part, press., in/put	kg/cm2 a				
39		Design temperature	°C	95		65	
40		Design pressure	kg/cm2 g	-1 TO 0.45		6	
41		Test pressure	kg/cm2 g	FULL VACUUM		9 *	
42				CASE 1			
43		OPERATING CONDITIONS PER UNIT		Fluid 1		Fluid 2	
44				Inlet	Outlet	Inlet	Outlet
45		Mass flow , total	kg/h	800.5		63875	
46		Mass flow , vapor / gas	kg/h				
47		Mass flow, steam	kg/h	747	3		
48		Mass flow, inerts	kg/h	53.5	53.5		
49		Mass flow liquid	kg/h				
50		mass flow, water	kg/h		744.5	63875	63875
51		operating temperature	°C	82.0	40.0	33.0	41.0
52		Operating pressure	kg/cm2 g	-0.61		3.0	
53		LIQUID					
54		Density	kg/m3		992.0	995.0	992.0
55		Specific heat	kcal/kg °C		0.9986	0.9987	0.9986
56		Thermal conductivity	kcal/hr m °C		0.5410	0.5341	0.5420
57		Dynamic viscosity	cP		0.6529	0.7337	0.6408
58		Heat of evaporation	kcal/kg °C				
59		Boiling point	°C				
60		Solidification point	°C				
61		STEAM / GAS					
62		Molar weight	kg/kmol	19.0	61.25		
63		Density	kg/m3	0.26	0.68		
64		Specific heat	kcal/kg °C	0.444	0.175		
65		Thermal conductivity	kcal/hr m °C	0.5700	0.1085		
66		Dynamic viscosity	cP	0.0116	0.0133		
67		Condensation temperature	°C				
68		Condensation enthalpy	kca/kg				
69		Fouling factor	hr m2 °C/kcal	0.00005		0.00015	
70		Velocity (mean)	m/s	*		*	
71		Pressure drop , admissible / calculated	kg/cm2	0.02/*		0.50/*	
72		Number of passes		*		*	
73		Corrected temperature difference	°C	*			
74		Heat duty	kcal/ hr	511000			
75		(Overall) Heat transf. coeff. , clean / dirty	kcal/ hr m2 °C	* / *			

FILE NAME :

Plant	Client	Contract Code	Document ID	Contract No.
350 MTPD Caustic Soda Expansion	**PACL**	**PACL- 350 TPD EXPN**	**0215-EQS-07-EC-0001**	**66- 0215-700**

thyssenkrupp

DATA SHEET FOR PLATE HEAT EXCHANGER (CASE 2 FOR 500 TPD Caustic Soda Plant)

Vapour Condenser
Item No. 07E02N

pacl
PACL LIMITED

SN	Rev							
1		Note 1 : Heat exchanger is to be designed for 10% excess area over dirty heat transfer coefficient.						
2								
3								
4				Fluid 1		Fluid 2		
5		Process fluid		MOIST CHLORINE		COOLING WATER		
6								
7		physical condition , in / out (S)olid, (L)iquid, (V)apour, (G)as		GAS	GAS/LIQUID	LIQUID	LIQUID	
8		Class of hazard		Corrosive				
9		pH-value						
10		H2-part, press., in/put	kg/cm2 a					
11		Design temperature	°C	95		65		
12		Design pressure	kg/cm2 g	-1 TO 0.45		6		
13		Test pressure	kg/cm2 g	FULL VACUUM		9 *		
14				CASE 2				
15		OPERATING CONDITIONS PER UNIT		Fluid 1		Fluid 2		
16				Inlet	Outlet	Inlet	Outlet	
17		Mass flow , total	kg/h	1143.50		91250		
18		Mass flow , vapor / gas	kg/h					
19		Mass flow, steam	kg/h	1067.40	3.6			
20		Mass flow, inerts	kg/h	76.10	76.10			
21		Mass flow liquid	kg/h					
22		mass flow, water	kg/h		1063.80	91250	91250	
23		operating temperature	°C	82.0	40.0	33.0	41.0	
24		Operating pressure	kg/cm2 g	-0.6		3.0		
25		LIQUID						
26		Density	kg/m3		992.0	995.0	992.0	
27		Specific heat	kcal/kg °C		0.9986	0.9987	0.9986	
28		Thermal conductivity	kcal/hr m °C		0.5410	0.5341	0.5420	
29		Dynamic viscosity	cP		0.6529	0.7337	0.6408	
30		Heat of evaporation	kcal/kg °C					
31		Boiling point	°C					
32		Solidification point	°C					
33		STEAM / GAS						
34		Molar weight	kg/kmol	19.0	61.25			
35		Density	kg/m3	0.26	0.68			
36		Specific heat	kcal/kg °C	0.444	0.175			
37		Thermal conductivity	kcal/hr m °C	0.5700	0.1085			
38		Dynamic viscosity	cP	0.0116	0.0133			
39		Condensation temperature	°C					
40		Condensation enthalpy	kca/kg					
41		Fouling factor	hr m2 °C/kcal	0.00005		0.00015		
42		Velocity (mean)	m/s	*		*		
43		Pressure drop , admissible / calculated	kg/cm2	0.02/*		0.50/*		
44		Number of passes		*		*		
45		Corrected temperature difference	°C	*				
46		Heat duty	kcal/ hr	730000				
47		(Overall) Heat transf. coeff. , clean / dirty	kcal/ hr m2 °C	* / *				

FILE NAME :

SN	Rev.	
1		1. Vendor to do thermal design of the exchanger for both Case 1 & 2. Present selection of no. of plates
2		is to be done to Case 1 with provision of upgradation to case 2 (including consideration of additional space,
3		foundation plan, load design, nozzle sizing and piping orientation.
4		
5		2. Exchanger shall not be dismantled after final hydrotest.
6		
7		3. Derusting and painting as per Manufacturer's standard. However vendor has to take prior approval
8		of procedure & painting specification from tkIS(India)/Client.
9		
10		4. Performance of heat exchanger shall be proved by vendor at site.
11		
12		5. Supply of foundation bolts, lifting lugs (in-built type) & earthing cleats shall be by vendor.
13		
14		6. Vendor to guarantee performance (i.e. thermal performance and pressure drop), suitability of materials offered
15		(in fluid contact) and mechanical design of the unit. Performance test run shall be demonstrated at site for
16		72 hours. In case of any discrepancy during guarantee period, Vendor shall replace the defective parts or
17		the whole heat exchanger free of cost in order to meet guaranteed performance.
18		
19		7. In case of gasket failure, vendor shall replace full set of gaskets free of cost, during the period of 18 months
20		from startup or 24 months from date of despatch whichever is earlier.
21		
22		8. Friction type spanner shall be supplied by the vendor for tightening bolts.
23		
24		9. Extra length of the tightening stud shall be protected by providing suitable sleeve of PVC / rubber /any
25		other suitable non-corrosive material
26		
27		10. Following inspection / tests shall be carried out at the vendors works in the presence of tkIS(India) / client.
28		a) Material identification & checking of material test certificates.
29		b) Checking of X-ray report as applicable and verification of internal quality testing documents.
30		c) UT / DP test for weld joints.
31		d) Final hydrotest
32		e) Dimensional checking
33		f) Checking of plate thickness (0.6mm minimum).
34		
35		11. Rack of heat exchanger is designed for 20% extra plates (spare plates) minimum over case 2 requirement
36		
37		12. Commissioning spares to be supplied without any extra cost by vendor.
38		Commissioning spare parts:
39		a) Ring gasket for end plate : 1 set (100% per exchanger)(If applicable)
40		b) Flow gasket: 2% (atleast 5 nos. per exchanger)
41		c) Nuts & washers for tie rods: 2 nuts + 2 washers per exchanger
42		d) Gasket for start plate: min. 1 no. per exchanger
43		13. Spares for 2 years trouble free operation shall be quoted separately.
44		2 years operation spare parts:
45		a) Ring gasket for end plate : 1 set (100% per exchanger)(If applicable)
46		b) Flow gasket: 2% (atleast 5 nos. per exchanger)
47		c) Nuts & washers for tie rods: 2 nuts + 2 washers per exchanger
48		d) Gasket for start plate: min. 1 no. per exchanger
49		
50		14. Personnel protection sheet of acrylic or other suitable material shall be provided for plates.
51		
52		15. Vendor to fill up data marked with '*'
53		
54		16. Minimum nozzle loads shall be considered as per API-662 Part1, Cl.7.7.10 Table 2.
55		Vendor shall check & incorprate revised loads if any during detail engineering without any extra cost if
56		thicknesses are not changing.
57		
58		17. The equipment shall be guaranteed for satisfactory performance as well as any sorts of manufacturing defects
59		for a period of 18 months from the date of commissioning or 24 months from the date of last despatch,
60		whichever is earlier.
61		
62		18. Supplies shall be carefully guaranteed against any manufacturing defect/ poor workmanship quality etc. for a
63		period of 18 months from the date of commissioning or for 24 months from the date of delivery whichever is
64		earrlier. During this period vendor will arrange to repair/ replace any defective part free of cost or replace
65		complete set, if required.
66		
67		19. Vendor shall provide all technical assistance for supervision of commissioning at free of cost.
68		
69		20 Vendor shall not use chinese made material or any part of the same.
70		

FILE NAME :

Plant	Client	Contract Code	Document ID	Contract No.
350 MTPD Caustic Soda Expansion	**PACL**	**PACL- 350 TPD EXPN**	**0215-EQS-07-EC-0001**	**66- 0215-700**

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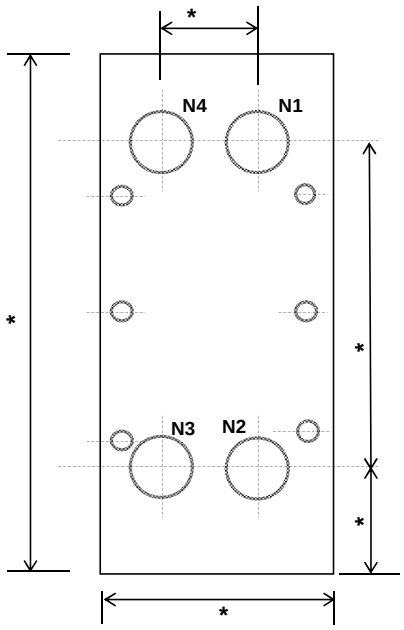
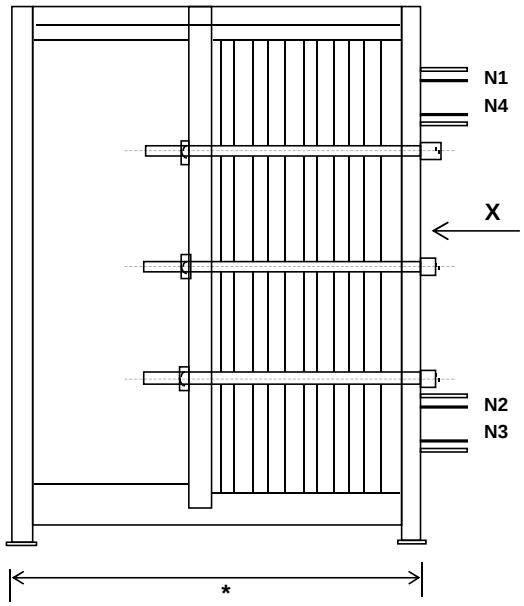
PRINCIPLE SKETCH

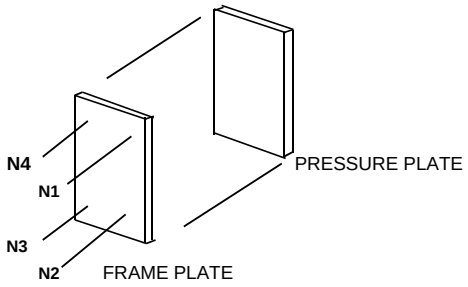
Vapour Condenser
Item No. 07E02N

PACL LIMITED



VIEW 'X'





Notes:

1) Vendor confirmed data marked ' * ' & furnished in offer.
2) Nozzle orientation and Designation with Nozzle Symbol given by tkIS in the Sketch and nozzle table below shall be followed by vendor.
3) If vendor proposal consists of non standard flanges (Other than B16.5) for nozzles, vendor shall also supply companion flange, spool of appx.75mm of process suitable material with gaskets & fasteners including spares.
4) Vendor shall take necessary precautions while deciding nozzle sizes with respect to fouling of nozzle flanges with PHE supporting arrangements.
5) Nozzle is to be sized as per case 2 requirement

Nozzle symbol	Designation	DN	NB	Standard	Flange Type	Flange facing	Nozzle length	Remarks
N1	WET CHLORINE INLET	*	*	ASME B16.5	*	RF	*	
N2	WET CHLORINE OUTLET	*	*	ASME B16.5	*	RF	*	
N3	COOLING WATER INLET	*	*	ASME B16.5	*	RF	*	
N4	COOLING WATER OUTLET	*	*	ASME B16.5	*	RF	*	

FILE NAME :

Plant	Client	Contract Code	Document ID	Contract No.
350 MTPD Caustic Soda Expansion	**PACL**	**PACL- 350 TPD EXPN**	**0215-EQS-07-EC-0001**	**66- 0215-700**

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INDEX OF APPLICABLE CODES AND STANDARDS

Vapour Condenser
Item No. 07E02N

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1		**1 DESIGN CODES**		
2	X	ASME Code Section VIII, Division 1 Edition 2017		
3		ASME Code Section VIII, Division 2 Edition 2017		
4		TEMA Standards, Class R, 2007- 9th Edition		
5		API 650, 12th Edition March 2013 with Addendum 2, January 2016		
6		API 620, 12th Edition October 2013 with Addendum 1, November 2014		
7	X	API 662 Part 1, 1st Edition February 2006 with Reaffirmed, February 2011		
8		EN 13121-3 : 2010A		
9		IBR 1950 with amendment Dec. 2008		
10	X	Manufacturer's Standards		
11		**2 REFERENCE STANDARDS**		
12		ESA 09 AU-ST-02(M)	Vessels & Equipment: Pressure Vessels General Specification	
13		UN 2000-01 Part 2(M)	Atmospheric vessels, general specification	
14		UN 2000-01 Part 3(M)	Vessels and equipment, field fabrication, general specification	
15		UN 2000-05 Part 1(M)	Saddle supports for horizontal steel vessels	
16		UN 2000-05 Part 4(M)	Supports For Vertical Steel Vessels; Skirt	
17		UN 2000-05 Part 5(M)	Supports For Vertical Steel Vessels; Legs	
18		UN 2000-05 Part 6	Supports For Vertical Steel Vessels; Brackets (Lugs)	
19		UN 2000-06 Part 2(M)	Clips for ladders, davits and platforms	
20		UN 2000-06 Part 3(M)	Clips for guide and support brackets for piping, type C	
21	X	UN 2000-09 Part 1(M)	Name plate for vessels	
22		UN 2000-09 Part 2(M)	Name plate for tanks	
23		UN 2000-11 Part 1(M)	Swivel devices for inspection openings	
24		UN 2002-01 Part 1	Vessels and equipment of glass fibre reinforced plastics; Technical delivery condition	
25		UN 2002-02 Part 1	Vessels and equipment of glass fibre reinforced plastics, with lining; Technical delivery condition	
26		UN 2002-03 Part 1	Vessels and equipment of glass fibre reinforced plastics; Typical configuration	
27		UN 2002-04	Transport and erection instructions for vessels and tanks of GRP	
28	X	UN 2003-01	Earthing connections for vessels and equipment	
29		UN 2004-05(M)	Internals; Vortex breakers, feed deflectors and ladder rungs	
30		UN 2004-06(M)	Insulation clips for vertical steel vessels	
31		UN 2100-01 Part 1	Tubular heat exchangers, general specification	
32		UN 2100-03(M)	Jack screw bosses at tube sheet for heat exchangers	
33		UN 5222-02 Part 1(M)	Fractionating Trays; General Specification	
34		UN 5222-02 Part 2(M)	Vessels, support grid	
35		UN 5222-02 Part 3(M)	Vessels, hold down grid	
36		UN V416-01 Part 1	Welding, welded joints for vessels and equipment, requirements	
37		UN V416-01 Part 2	Welding, welded joints for vessels and equipment, examples	
38		UN V416-02(M)	Vessels and equipment, tube-to-tubesheet joints	
39		UN V416-03 Part 1	Vessels and equipment, surface treatment of austenitic stainless steels after welding	
40		UN 2000-01 Part 1	Engineering of steel structures; design, fabrication, materials	
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51		**3 CLASSIFICATION GROUP and LEAKAGE CLASS**		
52		Vessel Group		
53		Heat Exchanger Shell Side Group	Tube Side Group	Leakage class DK
54		Not Applicable		
55		**4 FATIGUE LOADING**		
56		Design No. of load cycles	from kg/cm2 g	to kg/cm2g
57		**Remarks:**		

1			**General**
2		X	Stress analysis shall be performed by the manufacturer in accordance with design specifications
3		X	Specified wall thicknesses are minimum values and shall be increased if required by stress calculation
4		X	Nozzle necks shall be least DN 50/ 2". They shall be reduced to the required nominal flange size if necessary.
5		X	Bolts and nuts for joints with tapped holes have to be supplied by the vessel manufacturer.
6			
7			**Supplies shall include the following items**
8			Base ring template
9			Clips and pads for ladders and plattforms
10			Clips for davits
11			Davits for manholes
12			Clips and pads for pipe supports
13			Supports for insulation
14			Supports for fireproofing insulation acc. to UN 2000 - 05 part 4
15			Additional 1 sets of gaskets for flanges with cover and blind flanges
16			Additional 10% of bolts and nuts, as spare
17		X	Lifting lugs for erection
18			Lifting trunnions for erection
19		X	2 separate earthing connections to be provided 180 degree apart resp. 1 per saddle, if not otherwise specified
20		X	All internals
21			Set of glasses and gaskets for water gauges
22			Demister
23			Platforms and ladders plus bolts and nuts, as spare
24		X	Spare parts for 2 years to be quoted separately.
25			Bolts, nuts and gaskets for connecting piping
26			Test flange (quote separately)
27			Lifting lugs on channels and bonnets
28		X	Name plate
29		X	Anchor Bolts
30		X	For applicable standards see page ' index of applicable Codes and standards'
31		X	Commissioning spare parts
32			
33			**Additional requirements for heat exchangers**
34			Tubes to be welded into tube sheet and tested according to UN V416 - 02 part 1, Leakage class
35			Tubes to be expanded after welding
36			Tubes to be fixed by expansion
37			Expansion with grooves in tube sheet holes
38			Tube bundle to be equipped with 2 slide rails
39			Tube bundle to be equipped with sealing strips
40			For stacked heat exchangers an experimental assembly and pressure test shall be performed
41			Protection device for expansion bellows
42			
43			Pulling Lugs for tube bundle
44			Jackscrews and jack bosses according to UN 2100 - 03 part 2
45			Tube holes in baffles and support plates to be max. 0.4 mm over outer diameter of tubes
46			Holes' diameter in tube sheet according to standard fit
47			
48			
49			Remarks:

Plant	Client	Contract Code	Document ID	Contract No.
350 MTPD Caustic Soda Expansion	**PACL**	**PACL- 350 TPD EXPN**	**0215-EQS-07-EC-0001**	**66- 0215-700**

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SUMMARY OF ENGINEERING AND FINAL DOCUMENTS

Vapour Condenser
Item No. 07E02N

pacl
PACL LIMITED

SN	Pos.					
		The following engineering and final documents shall be furnished by the manufacturers :				
1		**Version and delivery date shall be specified**				
2						
3		**1.0 For engineering and approval**	**Quantity**			
4	Pos.	**Documents**	**Reproducible**	**Copy**	**Version**	**Delivery Dt**
5	1	Assembly drawing - Arrangement drawing & QAP	1)	1 soft	II	B
6	2	Foundation plan - Load plan		1 soft	II	B
7	3	Workshop drawing with part list			II	
8	4	Engineering data and specifications (tkIS(India) DATA SHEETS FILLED)		1 soft	II	A, B
9	5	Piping plan or piping diagram / P&ID				
10	6	Electrical diagrams (MOTOR DRAWINGS), Instrument list (Make / Type)				
11	7	Delivery schedule for equipment		1 soft	II	D.1
12	8	Sketch for equipment transport				
13	9	Erection instructions				
14	10	Stress analysis (for information)				
15	11	Product catalogue, Instrument Specs. Including Instruments & G.A. for Panel.				
16	12	Reference list for similar equipment				
17	13	Documents bearing tkIS(India)/Client notes shall be resubmitted	As Indicated Above			C
18		**2.0 SPARE PARTS**				
19	1	Quotation for two years operation & commissioning spares		1 soft	II	A
20	2	Spare part list with itemized drawing or sketches		1 soft	II	B
21						
22		**3.0 FINAL DOCUMENTS**				
23	1	Final documents as listed under 1.0		4 Hard+3soft	II	G
24	2	Instructions for operation and maintenance		4 Hard+3soft	II	
25	3	Erection instructions		4 Hard+3soft	II	
26	4	Table of lubricants and lubrication schedule				
27	5	Test certificates for explosion proof items of equipment				
28	6	Summary of antifriction bearings				
29	7	Stress analysis				
30	8	Exhaustive Component List				
31	9	Test Certificate of bought-out items				
32	10	Panel Wiring Diagram				
33	11					
34	12					
35		**4.0 INSPECTION**				
36	1	Shop inspection certificate		4 Hard+1soft	II	E
37	2	Inspection reports to DIN 50 049/3.1A-3.1C		4 Hard+1soft	II	E
38	3	Inspection reports issued by inspection authority such as TUV				
39	4	Inspection reports, stress-relieving diagrams, etc.				
40	5					

41	**5.0 Explanation of figures listed in column version**		Notes pertaining to column "delivery date""
42	I	Lettering or wording in German	A To be submitted with quotation
43			B 15 days after order placements
44	II	Lettering or wording in English	C Two weeks after return of documents
45			D One month after order placement, thereafter monthly
46	III	Lettering or wording in German and English	E Not later than date of final inspection
47			F One month after final inspection ; to be submitted with shipping
48	IV	Lettering or wording in German	documents if the equipment has to be shipped
49			G After final release, but not later than 4 weeks prior to final inspection 1 soft copy to GNAL, 1 soft copy to tkIS(I)-HO, 1 soft copy to tkIS(I)- site
50		**6.0 REMARKS :**	
51	1)	Standard size DIN A4 and smaller on white sheets, larger sizes on reproducibles	
52		NOTES :	
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FILE NAME :