





Plant <b>300 MTPD Caustic Soda Expansion</b>	Client <b>PACL</b>	Contract Code <b>PACL- 300 TPD EXPN</b>	Document ID <b>0215-EQS-11-EC-0001</b>	Contract No. <b>66-0215</b>	
	<b>Technical specification for</b> <b>Cell Rack Including Pressure Device &amp; Bus Bar System</b> <b>(Ton No. 11A01AN-FNZ01)</b> <b>UPGRADATION OF CAUSTIC SODA PLANT</b>			 <b>PACL LIMITED</b>	
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<p><b>TKIS - India / Vendor</b></p> <table style="width: 100%;"> <tr><td style="text-align: right;">Category Codes (Submission Purpose)</td><td style="text-align: center;"><input type="checkbox"/></td><td>1</td><td>For Approval</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>2</td><td>For Review / Comments</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>3</td><td>For Information</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>4</td><td>For Engineering</td></tr> <tr><td></td><td style="text-align: center;"><input checked="" type="checkbox"/></td><td>5</td><td>For Enquiry</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>6</td><td>For Order Placement</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>7</td><td>Final &amp; Approved</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>8</td><td>Released for Construction</td></tr> </table> <hr/> <table style="width: 100%;"> <tr><td style="text-align: right;">Acceptance Codes (Approval Codes)</td><td style="text-align: center;"><input type="checkbox"/></td><td>1</td><td>Approved</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>2</td><td>Approved for Manufacturing / Fabrication with Comments as marked</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>3</td><td>Not Approved / Resubmit</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>4</td><td>Retained for Information / Records</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>5</td><td>Reviewed</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>6</td><td>Reviewed as Noted / Resubmit</td></tr> </table> <p><b>Remarks for AC2 :</b> This marked-up drawings is hereby approved for fabrication / manufacturing and shall be re-submitted 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.</p> <p><b>This approval / review does not absolve the supplier from the full responsibility for design and fabrication.</b></p> <p>Date : __/__/____ Name : _____</p>	Category Codes (Submission Purpose)	<input type="checkbox"/>	1	For Approval		<input type="checkbox"/>	2	For Review / Comments		<input type="checkbox"/>	3	For Information		<input type="checkbox"/>	4	For Engineering		<input checked="" type="checkbox"/>	5	For Enquiry		<input type="checkbox"/>	6	For Order Placement		<input type="checkbox"/>	7	Final & Approved		<input type="checkbox"/>	8	Released for Construction	Acceptance Codes (Approval Codes)	<input type="checkbox"/>	1	Approved		<input type="checkbox"/>	2	Approved for Manufacturing / Fabrication with Comments as marked		<input type="checkbox"/>	3	Not Approved / Resubmit		<input type="checkbox"/>	4	Retained for Information / Records		<input type="checkbox"/>	5	Reviewed		<input type="checkbox"/>	6	Reviewed as Noted / Resubmit	<p><b>TKIS - India / Owner / Client</b></p> <table style="width: 100%;"> <tr><td style="text-align: right;">Category Codes (Submission Purpose)</td><td style="text-align: center;"><input type="checkbox"/></td><td>1</td><td>For Approval</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>2</td><td>For Review / Comments</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>3</td><td>For Information</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>4</td><td>For Engineering</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>5</td><td>For Enquiry</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>6</td><td>For Order Placement</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>7</td><td>Final &amp; Approved</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>8</td><td>Released for Construction</td></tr> </table> <hr/> <table style="width: 100%;"> <tr><td style="text-align: right;">Acceptance Codes (Approval Codes)</td><td style="text-align: center;"><input type="checkbox"/></td><td>1</td><td>Approved</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>2</td><td>Approved for Manufacturing / Fabrication with Comments as marked</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>3</td><td>Not Approved / Resubmit</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>4</td><td>Retained for Information / Records</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>5</td><td>Reviewed</td></tr> <tr><td></td><td style="text-align: center;"><input type="checkbox"/></td><td>6</td><td>Reviewed as Noted / Resubmit</td></tr> </table> <p>Date : __/__/____ Name : _____</p>	Category Codes (Submission Purpose)	<input type="checkbox"/>	1	For Approval		<input type="checkbox"/>	2	For Review / Comments		<input type="checkbox"/>	3	For Information		<input type="checkbox"/>	4	For Engineering		<input type="checkbox"/>	5	For Enquiry		<input type="checkbox"/>	6	For Order Placement		<input type="checkbox"/>	7	Final & Approved		<input type="checkbox"/>	8	Released for Construction	Acceptance Codes (Approval Codes)	<input type="checkbox"/>	1	Approved		<input type="checkbox"/>	2	Approved for Manufacturing / Fabrication with Comments as marked		<input type="checkbox"/>	3	Not Approved / Resubmit		<input type="checkbox"/>	4	Retained for Information / Records		<input type="checkbox"/>	5	Reviewed		<input type="checkbox"/>	6	Reviewed as Noted / Resubmit
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Rev.	Status	Description	Date	Prepared	Date	Checked	Date	Approved	AC
© Copyright 2018 : All rights reserved thyssenkrupp Industrial Solutions (India) Private Limited				<h1 style="margin: 0;">Barcode</h1>					Category Code: - 05

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### LIST OF DRAWINGS

SR. NO	1.1 DESCRIPTION	REV.
1.	(0200) General Assembly Cell Rack and Current Supply – 0215-EQS-11-TB-0001 Sht.1/2	00
2.	(0200) Details Cell Rack and Current Supply – 0215-EQS-11-TB-0001 Sht.2/2	00
3.	(0201) Cell Rack - 0215-EQS-11-TB-0002 Sht.1/3	00
4.	(0201) Cell Rack Bolt holes on bottom flange on H beam - 0215-EQS-11-TB-0002 Sht.2/3	00
5.	(0201.60) Intermediate Plate - 0215-EQS-11-TB-0002 Sht.3/3	00
6	(0202) Pressure Plate - 0212-EQS-11-TB-0003 Sht. 1/1	00
7.	(0201.51, 0210, 0216, 0267, 0268, 0287A) Parts of Insulation – 0215-EQS-11-TB-0004 Sht. 1/1	00
8.	(0205, 0207,0230) Rack Insulators, Insulators - 0215-EQS-11-TB-0005 Sht. 1/1	00
9.	(0211, 0212A/B, 0213, 0215, 0217) Parts for Pressure Devices - 0215-EQS-11-TB-0006 Sht.1/1	00
10.	(0206, 0208, 0233, 0260, 0260A, 0261) Detail of Supports for Headers and other parts - 0215-EQS-11-TB-0007 Sht. 1/1	00
11.	(0400) Personal Protection General Arrangement and Details - 0215-EQS-11-TB-0008 Sht.1/1	00
12.	(0221A/B, 0222A/B) Detail of Busbars - 0215-EQS-11-TB-0009 Sht. 1/1	00
13.	(0223A/B, 0229, 0270) Detail of Copper Flexibles - 0215-EQS-11-TB-0010 Sht. 1/1	00
14.	(0288, 0289) Detail of Instrument cable Duct - 0215-EQS-11-TB-0011 Sht. 1/1	00
15.	(0226, 0227) Detail of Busbars - 0215-EQS-11-TB-0012 Sht. 1/1	00
16.	(0280) Tightening sequence for pressure bolts - 0215-EQS-11-TB-0013 Sht. 1/1	00
17.	(0214) Conical Spring 34/16.3/1.5 Gr.2 – 0215-EQS-11-TB-0014 Sht. 1/1	00
18.	(0250) Guide Rail – 0215-EQS-11-TB-0015 Sht. 1/1	00
19.	(0201.74, 0293) Details for insulation cap – 0215-EQS-11-TB-0016 Sht.1/1	00
20.	(12H003) Element lifting beam - 0215-EQS-12-TB-0035 Sht 1/1	00
21.	(0218, 0219) Details for earthquake safety device 0215-EQS-11-TB-0017 Sht.1/1	00
22.	(0221A/B, 0222A/B) Technical specs of Copper Busbars - 0215-ELT-11-EC-0004	00
23.	(0223A/B, 0270, 0229) Technical specs for Copper Flexibles – 0215-ELT-11-EC-0002	00
24.	(0226, 0227) Technical specs of Copper Busbars - 0215-ELT-11-EC-0004	00

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1. SCOPE OF SUPPLY

(a) Supply, fabrication, painting, assembly, transportation and supervision of erection of cell rack assembly of electrolyser at **PACL, Panjab Nayanangal** site as per the drawings enclosed herewith (for list of drawings enclosed refer Page 2).

(b) Part Nos. 0223A/B, 0226, 0227, 0229 and 0270 (as applicable) shall be supplied by copper busbar manufacturer.

**Vendor shall supervise erection at above listed bus bars along with cell rack assembly at site. Vendor shall quote man day basis Separately for supervision activity at site.**

(c) **Part no. 0221A/B and 0222A/B shall be supplied by cellrack vendor.**

2. (a) No. of cell rack assembly per electrolyser - 2 Nos.

(b) No. of electrolyzers - 6 Nos.

Hence Total No. of Cell Rack assemblies – 12 Nos.



3. Surface preparation : Blast cleaning to Swedish Std. Sa. 2-1/2.

Painting : One coat of inorganic zinc silicate primer of 75 microns DFT. Inert Pigment / Epoxy resin 60 microns DFT as first top coat and 65 microns as second top coat. Total DFT 200 microns.



4. All bolts, nuts, washers, slotted counter sunk head screw, fasteners (except disc spring item No.0214) shall be zinc coated as per DIN 267 to A2E coating scheme. Item Nos. 0201.01, 0201.02, 0201.04, 0201.05 & 0201.07 have to be zinc hot dip galvanized according to DIN EN ISO 10684.

5. Conical springs, part No.0214 shall be according to drawing no. 0215-EQS-11-TB-0014.

6. Fabrication, Welding & Erection: As per good engineering practice and to the satisfaction of inspection of CLIENT / tkIS - India.

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7. All notes indicated in Drg. No. 0215-EQS-11-TB-0001 are applicable.
8. If required, vendor can prepare detailed fabrication drawings for their shop.  
(These drawings need not be submitted to tkIS - India).
9. Vendor to submit samples and chemical and mechanical properties of following items to tkIS (India) / Client for approval before procuring the same.  
Part Nos. 0201.51, 0205, 0207,0230, 0210, 0214, 0216, 0267, 0268, 0287A, 0293, 0401A, 0401B, 0401C, 0401D, 0401E, 0401F & 0402A/B.
10. All cell racks have to be assembled at the manufacturer's shop for final inspection and dispatch to site in assembled condition.
11. Ref. Drg. No. 0215-EQS-11-TB-0004: All the insulation parts (i.e. Part No.- 0201.51, 0210, 0216, 0267, 0268, 0287A) shall be fabricated in one piece (i.e. without any joints).
12. Inspection by CLIENT / tkIS (India).
13. All materials shall be supplied with test certificate.
14. All bolts, nuts, washers, counter sunk screws, springs shall be supplied with minimum 2% spare. Total quantity of spares for all electrolyzers are noted in Drg. No. 0215-EQS-11-TB-0001.
15. **Vendor shall check the foundation offered for erection prior to start up any activity.**

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**EQUIVALENT MATERIAL SPECIFICATION FOR  
INSULATION PLATE UP GM 201 WHITE DIN EN 60893 (=HM2471 DIN 7735) / HM 2472**

Glass fibre mat reinforced Unsaturated polyester resin bonded laminated sheet with good water resistance and machining characteristics. The insulating material shall conform to minimum requirements given below:  
Values ( ) are typical values intended to give only general guidance and are not to be considered as requirements of this standard.

	Property	Test method in IEC 893-2 Subclause	Unit	Max. or Min.	Nominal thickness of sheet to which test is applicable mm	Type	Remarks
						UP GM 201	
1	Flexural stress at rupture perpendicular to laminations	5.1	MPa	Min.	≥ 1.6	130	
2	Apparent module of elasticity in flexure	5.2	MPa	Min.	≥ 1.6	(8 000)	
3	Compressive strength perpendicular to laminations	5.3	MPa	Min.	≥ 5	(200)	
4	Impact strength (Charpy) parallel to laminations	5.5.2	kJ/m <sup>2</sup>	Min.	≥ 5	40	The requirement for impact strength Charpy and Izod are alternative. A material meeting either requirements shall be deemed to comply with the specification
5	Impact strength (Izod) parallel to laminations	5.5.3	kJ/m <sup>2</sup>	Min.	≥ 5	35	
6	Shearing strength parallel to laminations	5.6	MPa	Min.	≥ 5	(20)	
7	Tensile strength	5.7	MPa	Min.	≥ 1.6	(70)	
8	Electric strength at 90°C in oil perpendicular to laminations	6.1.2	kV/mm	Min.	≤ 3	AS PER EN 60893-3-5 (Table 5)	
9	Breakdown voltage at 90°C in oil parallel to laminations	6.1.3	kV	Min.	> 3	35	
10a	Permittivity at 48 Hz-62 Hz	6.2		Max.	≤ 3	4.5	Conformance with the requirement for either test constitutes conformance with the specification in this respect
10b	Permittivity at 1 MHz	6.2		Max.	≤ 3	4.5	
11a	Dissipation factor at 48 Hz-62 Hz	6.2		Max.	≤ 3	0.05	Conformance with the requirement for either test constitutes conformance with the specification in this respect
11b	Dissipation factor at 1 MHz	6.2	-	Max.	≤ 3	0.05	
12	Insulation resistant after immersion in water	6.3	MΩ	Min.	All	5 x 10 <sup>2</sup>	
13	Proof tracking index	6.4	-	-	≥ 3	500	
14	Comparative tracking index	6.4	-	Min.	≥ 3	(600)	
15	Tracking and erosion resistance	6.5	Class	Min.	-		Method 1 of IEC 587
16	Thermal endurance	7.1	T.I.		≥ 3	(130)	
17	Flammability	7.2	Category		3		
18	Temperature of deflection under load	7.3	°C			Under consideration	
19	Density	8.1	g/cm <sup>3</sup>	Range	All		
20	Water absorption	8.2	mg	Max.	All	AS PER EN 60893-3-5 (Table 7)	