





Plant CAUSTIC SODA	Client Punjab Alkali	Contract Code PACL	Document ID 0215-ELT-00-EC-0022	Contract No. 66-0215
	TECHNICAL SPECIFICATIONS LOW VOLTAGE CABLES			
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<p>TKIS - India / Vendor</p> <p>Category Codes (Submission Purpose)</p> <ul style="list-style-type: none"> <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 <hr/> <p>Acceptance Codes (Approval Codes)</p> <ul style="list-style-type: none"> <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>Remarks for AC2 : 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>This approval / review does not absolve the supplier from the full responsibility for design and fabrication.</p> <p>Date : ___/___/___ Name : _____</p>	<p>TKIS - India / Owner / Client</p> <p>Category Codes (Submission Purpose)</p> <ul style="list-style-type: none"> <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 <hr/> <p>Acceptance Codes (Approval Codes)</p> <ul style="list-style-type: none"> <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>Date : ___/___/___ Name : _____</p>
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Rev.	Status	Description	Date	Prepared	Date	Checked	Date	Approved	AC
Based on: PIN-LES-ELT-1017, Rev.0, 12-2015				<h1 style="font-size: 2em;">Barcode</h1>					Category Code: - 05
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INDEX SHEET

The document Cover Sheet indicates revisions made in this document along with the purpose of issue of the revised document. The details of revisions made in the enclosures of this document are listed in the table of *Contents* below and the enclosures listed therein are an integral part of this document.



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	SITE CONDITIONS			pacl	
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Sr. No.	Description	Site Condition
1.	Location	Gandhidham, Gujrat
2.	Altitude	16 meters above MSL
3.	Ambient Temperature - Maximum	50 Deg C
4.	Ambient Temperature – Minimum	7.5 Deg C
5.	Design Ambient Temperature (For Electrical Equipment)	50 Deg C
6.	Max. Relative Air Humidity	90 % at 50 Deg C
7.	Rainfall (Max.)	** mm per hour
8.	Seismic Zone	Zone-V as per Part-4 of IS-1893
9.	Soil Resistivity	** Ohm-meter
10.	Thermal Resistivity of soil	** Deg. K.m/watt
11.	Presence of Corrosive atmosphere	Yes, Highly Corrosive, laden with traces of sulphur di/tri-oxide. Abrasive dust and coal particles (5-100 microns) with traces of Cl ₂
12.	Tropicalizing required	Yes

** : Data to be provided later by tkIS-India

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	TECHNICAL SPECIFICATIONS – Part-I LOW VOLTAGE CABLES				
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1.0 INTRODUCTION

This specification is intended to cover general requirements of manufacture, testing, inspection and despatch for **Low Voltage power, control, lighting and earthing cables** for working voltages up to and including 1100V.

Design, manufacturing, testing and performance of Low Voltage Cables shall comply with all currently applicable Indian & IEC Standards and specific Standards & Codes specified under clause 'Codes' of Part-II of this specification.

Scope of supply and services covered under this specification shall be as per various parts of this specification. Offer shall be submitted as per Part IIIA, 'Notes on Method of Offer Submission'. Standard and descriptive requirement is covered in Part-I while specific requirement is covered in Part-II. Requirements for testing at vendor's works are covered in Part-IV.

2.0 GENERAL REQUIREMENTS

2.1 Conductor

The conductor shall be uniform, solid/ stranded, electrical grade aluminium/ copper as specified in Part-II.

2.2 Core Identification

For twin, three and multi-core cables (up to 5 cores), core identification shall be by different colors of PVC/ XLPE insulation as specified in relevant IS. For multicore cables having more than 5 cores, core identification shall be done by numbers. In this case, insulation of cores shall be of same colour and numbered sequentially starting by number 1 in the inner layer. For neutral conductor the core shall have number '0'.

2.3 Insulation

Conductor insulation shall be extruded PVC/ XLPE as specified in Part-II.

2.4 Inner Sheath

In case of multicore cables, extruded PVC inner sheath, as specified in Part-II, shall be applied over laid up cores.

Single core cables shall have no inner sheath.

2.5 Armouring



Armouring shall be provided for single/ multicore cables if specified in Part-II.

For multicore cables, armour type shall be galvanized round steel wire armour in case calculated diameter below armouring does not exceed 13 mm and galvanized steel formed wires/ strip armour in case calculated diameter below armouring is greater than 13 mm.

For single core cables armour shall be made up of hard-drawn aluminium round wire armour.

2.6 Outer Sheath

PVC outer sheath shall be applied by extrusion over the insulation/ armour/ inner sheath as per relevant IS. Material & colour shall be as specified in Part-II. Suitable chemicals shall be

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added into the PVC compound of outer sheet to protect the cable against the rodent & termite attack. The outer sheath shall be embossed or printed with the following details at intervals as specified in Part-II:

- a. No. of cores and size of cable.
- b. Manufacturer's identification.
- c. Year of manufacture.
- d. Voltage grade.
- e. Length marking by embossing or printing (every one meter or as specified in Part-II).

2.7 Fire Retardant Properties

Cables shall have Fire Retardant (FR) or Fire Retardant Low Smoke (FRLS) properties if specified in Part-II.

3.0 FACTORY ACCEPTANCE TEST AND DESPATCH

Inspection & testing shall be carried out based on latest revision of this specification released for manufacture (order specification). Purchaser/ Purchaser's representative shall have the right to carry out stage inspection and shop visit to review the manufacturing progress. However, manufacturer need not hold any of the manufacturing activity for witnessing of stage inspection by Purchaser/ Purchaser's consultant.



Tests as specified in Part-IV of this specification shall be carried out during final inspection. A minimum fifteen days advance notice shall be given for witnessing final inspection.

Vendor shall ensure that all meters and associated testing equipment are calibrated by an authorized testing laboratory and the calibration certificates are valid at the time of carrying out the testing of material.

After successful completion of inspection and testing, vendor shall furnish all as-built documents in required number of sets. Only after receipt of final documents in tkIS India office, the release order for dispatch of material will be issued.

The cable shall be wound on a wooden drum, ends sealed and packed as specified in relevant standards. The cable drum shall carry the following information either stenciled on the drum or contained in a label attached to it:



- a. Reference to the relevant standards.
- b. Manufacturer's name or trade mark.
- c. Type of cable and voltage grade.
- d. Number of cores.
- e. Nominal cross-sectional area of conductor.
- f. Cable code.
- g. Length of cable on the drum.
- h. Number of lengths on the drum (if more than one).
- i. Direction of rotation of drum (by means of an arrow).
- j. Gross weight.
- k. Country of manufacture.
- l. Year of manufacture.



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4.0 GUARANTEE

The technical particulars for cables furnished in Part-II shall be guaranteed within the tolerance specified or as permitted by relevant standards. In case of failure of the equipment to meet the guaranteed performance, the Purchaser reserves the right to reject the cables. If any of the cables supplied by the vendor fails at site during erection, commissioning or service (within guarantee period) the vendor shall replace the failed material within the time frame agreed with the Purchaser and at no extra cost to the Purchaser. The Purchaser also reserves the right to use rejected material till it is replaced.



The period of guarantee of the equipment shall be as per the agreed “Commercial Terms & Conditions”.

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		PART - II DESIGN DATA SHEET		Doc.		0215-ELT-000-EC-0022		
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GENERAL	001	Make	:				*	
	002	Voltage Grade	:	1100	volts			
	003	Quantity	:	As per Part-IIIB				
	004	Tolerance (on overall length for a particular size/ type)	:	1%				
	005	Tolerance (on drum length)	:	+ 2% (no negative tolerance)				
	006							
CODES & STANDARDS	007	IS-8130 : Specification for conductors for insulated electric cables and flexibles cords						
	008	IS-5831 : Specification for PVC insulation & sheath of electric cables						
	009	IS-7098 : Specification for cross linked polyethylene insulated PVC sheathed cables Part 1: for working voltage up to and including 1100 V						
	010	IS-1554 : Specification for PVC insulated (heavy duty) electric cables Part 1: for working voltages up to and including 1100 V						
	011	IS-3975 : Specification for low carbon galvanised steel wires, formed wires and tapes for armouring of cables						
	012	IS-10810 : Methods of test for cables						
	013	IS-10418 : Specification for drums for electric cables						
	014	CEA Regulations						
	015	Fire Insurance Authority Regulations						
CONSTRUCTION	016	Conductor						
	017	Material	:	Al Power cables >4 / Culess than 4 sqmm				
	018	Aluminium Conductor details						
		a) Type	:	Circular/ sector shaped				*
		b) Grade	:	H2 / H4				*
		c) Class	:	Class 2 (Stranded) as per IS 8130				
		d) Stranded Conductor	:	6 mm ² and above				
		e) Solid Conductor	:	NA				
	019	Copper Conductor details						
		a) Type	:	Circular/ sector shaped				*
		b) Class	:	Class 1 (Solid) / Class 2 (Stranded) as per IS 8130				
		c) Stranded Conductor	:	2.5 sq. mm and above (as per Part-IIIB)				
		d) Solid Conductor	:	Up to 2.5 sq. mm (as per Part-IIIB)				
		e) Tin coating required	:	No				
	020	Insulation		:	XLPE for Power & Lightng and PVC control & Earthing			
	021	Type	:	Extruded				
	022	Conductor Temperature						
		a) Rated	:	90 ⁰ C (XLPE) / 70 ⁰ C (PVC)				
		b) During short circuit	:	250 ⁰ C (XLPE) / 160 ⁰ C (PVC)				
	023	Inner sheath						
		a) Material	:	PVC Type ST1 for PVC cables				
			:	PVC Type ST2 for XLPE cables				
		b) Type	:	Extruded				
	c) Colour	:	Black					
024								

 	LOW VOLTAGE CABLES PART - II DESIGN DATA SHEET		Code		Caustic Soda, PACL	
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CONSTRUCTION	025	Armour				
	026	Single core cables				
		a) To be provided	:	Yes except earthing not required.		
		b) Material	:	Aluminium		
		c) Type	:	Single layer round wire armour		
	027	Multi core cables				
		a) To be provided	:	Yes except specific application not required.		
		b) Material	:	Galvanised steel		
		c) Type	:	Single layer round wire/ flat strip as per cl. 2.5 of Part-I		
	028	Outer Sheath	:			
		a) Material	:	PVC Type ST1 for PVC cables		
			:	PVC Type ST2 for XLPE cables		
		b) Type	:	Extruded		
		c) Colour	:			
		i) For single core power cables	:	Black		
		ii) For single core earthing cables	:	Green for Dirty earth & Yellow-Green clean Earth		
		iii) For twin, three & multicore cables	:	Black		
		d) Embossment / Printing interval	:	Every 1 m		
		e) Special requirements for outer sheath to suit chemicals or fumes handled in plant	:	Yes		
	f) Anti-rodent and Anti-termite	:	Yes			
	g) UV rated	:	Yes			
029						
FRLS/FR DATA	030	Fire retardant properties	:			
		i) Fire retardant (FR)	:	No		
		ii) Fire retardant low smoke (FRLS)	:	Yes		
	031	FRLS / FR Data	:			
		a) Minimum oxygen index	:	29 at 27±2°C		
		b) Minimum Temperature index	:	21 at 250°C		
	032	Data for FRLS cables only	:			
		a) Maximum acid gas generation	:	20 % by weight		
	b) Smoke density rating	:	60% maximum			
	e) Light transmittance	:	≥60%			

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1. Offer shall be submitted in two parts viz. *Technical* part and *Price* part.
2. Technical part shall consist of following:
 - a. Copy of “**General Specifications**” of this specification with acceptance of all clauses to be indicated by letter 'A' on right side of the specification sheet with seal of the company and initial of authorised person. Deviations, if any, should be indicated by letter 'D'.
 - b. Copy of “**Design Data Sheet**” of this specification duly filled in clearly and legibly in the assigned space against items marked thus '*', along with all documents requested with the offer.
 - c. Copy of “**Scope of Supply & Schedule of Prices**” of this specification marked 'quoted' against each item, to confirm that the vendor is making an offer as per break up requested therein.
 - d. “**Inspection Test Plan**” of this specification with acceptance of all clauses to be indicated by letter 'A' and duly signed.
 - e. Covering letter enclosing above document.
 - f. Filled up “**Compliance Declaration**” of this specification with seal of the company and initial of the authorized person.
3. Price part shall consist of following:
 - a. Copy of “**Scope of Supply & Schedule of Prices**” of this specification with unit rate of each item and total price of each section, with total price of the tender, including supplies and various services as specified or as recommended by the vendor.
 - b. Covering letter enclosing above price part and deviation on commercial terms if any.
4. Both the parts of offer shall be submitted in separate sealed envelope indicating details of offer such as *Technical* or *Price* part, enquiry no. and date of submission.
5. Offer will be evaluated based on above documents only and any other document enclosed with the offer shall not be considered for evaluation of offer.

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EQUIPMENT & SERVICES TO BE FURNISHED UNDER THIS SPECIFICATION

Following Cables as Detailed Below: (Drum number & drum length will be given to selected vendor during order placement.)



Sr. No.	Cable Size & Type	Length (meters)	Unit Rate (Rs.)	Total (Rs.)
1	Cables of following size and type			
A	<u>POWER CABLES:</u> Stranded Aluminium conductor, extruded XLPE insulation, extruded PVC inner sheath, armoured, overall PVC outer sheath (FRLS)			
a.	3 C x 6 sq. mm (A2XWY)	UR		
b.	3 C x 10 sq. mm (A2XWY)	840		
c.	3 C x 16 sq. mm (A2XWY)	800		
d.	3 C x 25 sq. mm (A2XFY)	UR		
e.	3 C x 35 sq. mm (A2XFY)	940		
f.	3 C x 50 sq. mm (A2XFY)	2022		
g.	3 C x 70 sq. mm (A2XFY)	690		
h.	3 C x 95 sq. mm (A2XFY)	UR		
i.	3 C x 120 sq. mm (A2XFY)	500		
j.	3 C x 150 sq. mm (A2XFY)	515		
k.	3 C x 185 sq. mm (A2XFY)	325		
l.	3 C x 240 sq. mm (A2XFY)	UR		
m.	3 C x 300 sq. mm (A2XFY)	UR		
n.	3.5 C x 25 sq. mm (A2XFY)	640		
o.	3.5 C x 35 sq. mm (A2XFY)	UR		
p.	3.5 C x 50 sq. mm (A2XFY)	1555		
q.	3.5 C x 70 sq. mm (A2XFY)	UR		
r.	3.5 C x 95 sq. mm (A2XFY)	UR		
s.	3.5 C x 120 sq. mm (A2XFY)	UR		
t.	3.5 C x 150 sq. mm (A2XFY)	340		
u.	3.5 C x 185 sq. mm (A2XFY)	UR		
v.	3.5 C x 240 sq. mm (A2XFY)	UR		
w.	3.5 C x 300 sq. mm (A2XFY)	3425		
x.	4 C x 6 sq. mm (A2XWY)	UR		
y.	4 C x 10 sq. mm (A2XWY)	UR		
z.	4 C x 16 sq. mm (A2XWY)	UR		
aa.	4 C x 25 sq. mm (A2XFY)	UR		



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Sr. No.	Cable Size & Type	Length (meters)	Unit Rate (Rs.)	Total (Rs.)
Ab.	4 C x 35 sq. mm (A2XFY)	UR		
Ac.	4 C x 50 sq. mm (A2XFY)	UR		
Ad.	4 C x 70 sq. mm (A2XFY)	UR		
Ae.	4 C x 95 sq. mm (A2XFY)	UR		
Af.	4 C x 150 sq. mm (A2XFY)	UR		
Ag.	4 C x 185 sq. mm (A2XFY)	UR		
Ah.	4 C x 240 sq. mm (A2XFY)	UR		
Ai.	4 C x 300 sq. mm (A2XFY)	UR		
Aj	5 C x 35 sq. mm (A2XFY)	500		
AK	*3CX 35 sq.mm (A2XY)	350		
5 core x 35 sq.mm cables are required for 3 Phase , Neutral with earth Power socket outlets. * 3CX 35 sq.mm (A2XY) unarmoured cable are required for Cell house between Polarization Rectifier to Bus bars.				
B	<u>POWER CABLES:</u> Stranded Copper conductor, extruded XLPE insulation, extruded PVC inner sheath, armoured, overall PVC outer sheath (FRLS)			
a.	3 C x 2.5 sq. mm (2XWY)	3630		
b.	3 C x 4 sq. mm (2XWY)	300		
c.	4 C x 4 sq. mm (2XWY)	UR		
C	<u>CONTROL AND LIGHTING CABLES:</u> Stranded Copper conductor, extruded XLPE insulation for Lighting & PVC for control, extruded PVC inner sheath, armoured, overall PVC outer sheath (FRLS)			
a.	3 C x 2.5 sq. mm (2XWY)			
b.	4 C x 2.5 sq. mm (2XWY)	690		
c.	5 C x 2.5 sq. mm (2XWY)	2620		
d.	7 C x 2.5 sq. mm (2XWY)	2060		
e.	10 C x 2.5 sq. mm (2XWY)	2822		
f.	12 C x 2.5 sq. mm (2XWY)	UR		
g.	16 C x 2.5 sq. mm (2XWY)	UR		
h.	3 C x 2.5 sq. mm (2XWY)- Lighting Solid conductor	10000		
D	<u>EARTHING CABLES:</u> Stranded Aluminium conductor, extruded PVC insulation, overall FRLS PVC sheath.			
a.	1C x 6 sq. mm (AYY)	500		

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Sr. No.	Cable Size & Type	Length (meters)	Unit Rate (Rs.)	Total (Rs.)
b.	1C x 16 sq. mm (AYY)	400		
c.	1C x 35 sq. mm (AYY)	250		
d.	1C x 70 sq. mm (AYY)	250		
e.	1C x 120 sq. mm (AYY)	250		
2	Tests as specified in Part-IV of this specification shall be performed in presence of Purchaser's representative, if so desired by the Purchaser. Extra cost for any of the tests shall be quoted indicating the reference item no. & description as per Part-IV of this specification.			
a.	Type Tests			
b.	Routine Tests		Included in basic price in Sr. No. 1 above	
c.	Acceptance Tests			
d.	Optional Tests		-	-
	TOTAL PRICE OF CABLES INCLUDING ALL ABOVE ITEMS			Rs.

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		PART - IV			Contract no.		66-0215-700	
		INSPECTION TEST PLAN			Doc.		0215-ELT-000-EC-0022	
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Sr. No.	Tests	Reference documents	Sample Size	Scope of Inspection				
				Vendor	Client / tkIS India / Third Party	Remark		
B) Routine Tests								
a)	Conductor Resistance Test	IS 1554, IS 7098, IEC 60502	100%	P	W			
b)	High Voltage test at room temperature	-do-		P	W			
c)	Visual Inspection of drum details, size, marking on end cappings/ outer sheath, Colour coding etc.	-do-		P	W			
d)	Dimensional checks - OD, conductor, insulation, sheath, armour etc.	-do-		P	W			
D) Acceptance Tests								
a)	Dimensional checks - overall, individual cable part & under armour	IS 1554, IS 7098, IEC 60502	IS 1554/ IS 7098 as applicable	P	W			
b)	Visual Inspection of drum details, size, marking on end cappings/ outer sheath, Colour coding etc.	-do-	100% for drum details and sample drum for balance details	P	W			
c) Tests on Conductor								
i	Annealing test (for Copper)	IS 1554, IS 7098	IS 1554/ IS 7098 as applicable	P	W			
ii	Tensile Test (for Aluminium)	-do-		P	W		See Note 1	
iii	Wrapping test (for Aluminium)	-do-		P	W		See Note 1	
iv	Conductor resistance test	-do-		P	W			
d) Test for PVC insulation & sheath								
i	Test for thickness of insu. & sheath	IS 1554, IS 7098	IS 1554 / IS 7098 as applicable	P	W			
ii	Tensile strength & elongation at break of insulation & sheath	-do-		P	W			
iii	Insulation resistance (volume resistivity) test	-do-		P	W			
iv	High Voltage test at room temperature	-do-		P	W			
f) Test for XLPE Insulation								
i	Tests for thickness of Insulation	IS 7098	IS 7098, IEC 60502 as applicable	P	W			
ii	Hot set test	IS 7098, IEC 60502		P	W			
iii	Tensile strength & elongation at break	IS 7098		P	W			
iv	High Voltage test at room temp.	IS 7098		P	W			
v	Insulation Resistance test(Volume resistivity) test	IS 7098		P	W			
Note:								
1. These tests are not applicable for stranded compacted circular conductors or shaped conductors (as per IS 8130)								

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Compliance Declaration

Please note that vendor shall indicate his replies to the following points without which the offer shall be liable for rejection.

Deviations if any from this specification shall be listed in the enclosed format (List of Deviations) indicating the applicable specification clause. The vendor will be made liable for full compliance with the specification requirements, if deviations are not listed in “List of Deviations” as it will be deemed as “No deviation”.

S.NO.	DESCRIPTION	EXPECTED REPLY	CONFIRMATION BY VENDOR	REMARKS
1.	Confirm that all deviations against this specifications are consolidated under “List of Deviations”. Deviations mentioned elsewhere will not be taken into consideration.	No Deviation		
2.	Confirm that there is no discrepancy in the technical details outlined in the specification and the technical bid data.	No Discrepancy		
3.	Relevant Catalogues/ literature giving specifications for all cables offered including sizing data is enclosed with the offer.	Yes		
4.	Relevant Catalogues/ specifications of all bought out items are enclosed with the offer.	-	-	Not applicable
5.	Quoted for “Spare parts recommended for 2 years continuous trouble-free operation” along with listing	-	-	Not applicable
6.	Quoted and offered recommended Commissioning spares along with listing	-	-	Not applicable
7.	Quoted for “Mandatory spares”	-	-	Not applicable

(Signature of Vendor)

Name :
Designation :
Date :

(Company Seal)

