NOTICE INVITING BID
FOR
AN INTEGRATED SUGAR COMPLEX

COMPRISING OF:

Sugar plant of 1500 TCD (22 hrs. / per day) Expandable to 2500 TCD, to produce premium quality sugar, along with bagasse based Co-Generation Power Plant of 4.95 MW on Turnkey basis at Chak 23-F, Kaminpura about 30 KM. away from Sriganganagar City on Srikaranpur-Sriganganagar road,

FOR

RAJASTHAN STATE GANGANAGAR SUGAR MILLS LTD
HEAD OFFICE, JAIPUR, RAJASTHAN.

Rajasthan State Ganganagar Sugar Mills Ltd.

Head Office :- 4th Floor, Bhawani Singh Road, Nehru Sahkar Bhawan, Jaipur – 302006, Tel.No. 0141-2740841, 0141-2740676 (Fax.) Web site: www.rsgsm.in & E-mail :- rsgsmlimited@yahoo.com

Sriganganagar :- **Rajasthan State Ganganagar Sugar Mills Ltd.**
Sriganganagar, Tel. No :- 0154-2470062, 0154-2480122(Fax),
Web site:- www.rsgsm.in & E-mail :- rsgsmsgnr@yahoo.co.in

TENDER SHOULD BE UPLOADED IN PDF FORMAT ONLY

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Rajasthan State Ganganagar Sugar Mills Ltd.

4th Floor, Bhawani Singh Road, Nehru Sahkar Bhawan, Jaipur - 302006
Tel.No. 0141-2740841, 0141-2740676 (Fax.) Web site: www.rsgsm.in

NIB No :

NOTICE INVITING BIDS

RSGSM invites E-Tender from eligible Tenderers to set up **complete Sugar plant of 1500 TCD (22 hrs. / per day) Expandable to 2500 TCD, to produce premium quality sugar, along with bagasse based Co-Generation Power Plant of 4.95 MW on Turnkey basis and to** provide for one year technical supervision staff which include carrying out activities for Designing, Manufacturing, Supplying, Supervision, erection & commissioning and Sucessful performance of plant and machinery of Integrated Sugar Complex and to provide for one year technical supervision staff at Kaminpura about 30 KM. away from Sriganganagar City on Srikaranpur-Sriganganagar road, as per the specifications/ details given in the bid document and as per the schedule given below:-

1.	**Name of the Department**	**Rajasthan State Ganganagar Sugar Mills Ltd.,**
2.	Procedure for obtaining and submission of bid documents	Tender form is to be downloaded from the web site eproc.rajasthan.gov.in Tender shall be accepted only online (e-procurement).
3.	Price of bid document	Rs. 10000/- DD (Demand Draft from any **scheduled bank** in favour of RSGSM payable at jaipur)
4.	Processing Fee for e-procurement charges	Rs. 1000/- DD (Demand Draft from any **scheduled bank** in favour of M.D.,RISL,jaipur)
5.	Bid-Security	Rs. 100.00 lacs ,out of which 25 lacs through DD and 75 lacs through B.G. from any **scheduled bank**.BG to be valid for six months.
6.	Last date for downloading of the bid document	4 th JUly , 2013 upto 2.00 PM
7.	Pre bid meeting date	14 th June , 2013 at 12.00 PM
8.	Pre bid venue	Board Room, 4th Floor, Bhawani Singh Road, Nehru Sahkar Bhawan, Jaipur – 302006
9.	Last date & time of submission of bids	4 th JULY, 2013 upto 6.00 PM
10.	Opening of Technical bid	5TH JULY, 2013 at 4.00 PM
11.	Opening of Financial Bid	To be intimated separately.
12.	Validity of bid (from the date of opening of Technical Bid)	120 Days

Tender form must be downloaded from the website www.eproc.rajasthan.gov.in Tender shall be accepted only online (e-procurement). D. D. for E-tendering process fee (Rs. 1000/- for each tender in favour of M.D.,RISL Jaipur). Tender form fee for the tender Rs. 10000/- & Bid-Security drawn in favour of RSGSM Ltd., Jaipur must be deposited in the office of RSGSM Ltd., HO, Jaipur before Submission time of Tender. Tender without Bid-Security shall not be accepted. The Technical Bid & Financial Bid shall be uploaded separately by the tenderer. Financial Bid of Tenderer who qualifies in technical bid would only be downloaded/opened later on, the date to be intimated by RSGSM. Management reserves the right to reject any/all tender/s without assigning any reason thereof. **This tender shall be processed through e-procurement portal of Govt. of Rajasthan however in case of any failure in this process the RSGSM may decide for conventional manual tender procedure.**

Dy. General Manager (P&S)

RAJASTHAN STATE GANGANAGAR SUGAR MILLS LIMITED
Regd. Office: 4th FLOOR, NEHRU SAHKAR BHAWAN, BHAWANI SINGH ROAD, JAIPUR-302006
(Tel. No. 0141-2741085, 0141-2740676(Fax) E-mail :- rsgsmlimited@yahoo.com)

NIB No :

Online Bids are invited upto 6.00 PM of 04 th july , 2013 for procurement of Sugar plant of 1500 TCD (22 hrs. / per day) Expandable to 2500 TCD, to produce premium quality sugar, along with bagasse based Co-Generation Power Plant of 4.95 MW on Turnkey basis at Chak 23-F, Kaminpura about 30 KM. away from Sriganganagar City on Srikaranpur-Sriganganagar road. Details may be seen in the Bidding Document at our official website www.rsgsm.in or the website of State Public Procurement Portal http://sppp.raj.nic.in The bid documents must be downloaded/uploaded on website www.eproc.rajasthan.gov.in only. Bid application fee is Rs. 10000/-.

Note :- Any clarification/ amendment/ corrigendum after publication of the NIB shall be uploaded on the e-procurement website i.e. (www.eproc.rajasthan.gov.in) only.

Dy. General Manager (P&S)

Rajasthan State Ganganagar Sugar Mills Limited
4th Floor, Nehru Sahkar Bhawan, Bhawani Singh Road, Jaipur – 302 006 (Rajasthan)
E-mail:- rsgsmlimited@yahoo.in

Instructions for submission of online Tender & documents

1. Scanned copies of tender form and other relevant documents signed & Sealed by Tenderer should be submitted online only.
2. If required by the Tenderer, training for online bidding may be given by DOIT, Yojna Bhawan. Tenderer may contact: E-Procurement cell, I st Floor, Yojna Bhawan, Jaipur.
   Help Desk Phone- 0141-4022688
   Email- eproc@rajasthan.gov.in
   Website- www.eproc.rajasthan.gov.in
3. Tenders are to be submitted online only. Hence, rates offered in hard copy would not be accepted.
4. Please read carefully the steps of submitting Tender online.
5. Please call on 0141-4022688/E-procurement cell/RSGSM Office (IT cell) 0141-2740475, for any assistance.

Rajasthan State Ganganagar Sugar Mills Limited
4th Floor, Bhawani Singh Road, Nehru Sahkar Bhawan,
JAIPUR - 302006 –RAJASTHAN
Phones : 0141-2741085 Fax : 0141-2740676 E-mail :- rsgsmlimited@yahoo.in

1. The Tenderers are required to deposit the following amount/ Bank Guarantee in the manner prescribed below against each item in the office of RSGSM, Nehru Sahkar Bhawan, Jaipur :-

S. No.	Details of Fee/ Bid-Security	Amount	Mode of Payment	Payable in Favour of
1	Tender Form Fee	10000/-	Demand Draft from any **scheduled bank.**	RSGSM, Ltd.Jaipur
2	Bid-Security (2% of estimated project cost)	100.00 lacs	Rs. 100.00 lacs ,out of which 25 lacs through DD and 75 lacs through B.G.from any **scheduled bank**).	RSGSM, Ltd.Jaipur
3	E-Tendering Process Fee	1000/-	Demand Draft from any **scheduled bank.**	Managing Director, RISL, Jaipur

The DD/B.G. of the above stated amounts are to be deposited by the Tenderers mandatorily in the office of RSGSM, Head Office, Jaipur upto 04th JULY, 2013 upto 6.00 PM positively.

2. After the issuance/ Uploading of NIB, any amendments/ corrigendum/ addenda shall be issued/ uploaded only on the E-procurement website i.e. www.eproc.rajasthan.gov.in of the State Government. No request for intimation of such amendments/ clarifications/ corrigendum/ addenda by E-mail/ letters shall be considered.

3. **Instructions to Bidder for E-Tendering Process:-**

I. The probable Tenderers intending to participate in this tender are required to get themselves registered on the website www.eproc.rajasthan.gov.in. Digital Signature Certificate **(DSC) Type-II** is required under **Information Technology Act-2000**. The Digital Signature, which will be used for signing the online bids, can be obtained by the Tenderers from the agencies authorized by **Controller of Certifying Authorities (CCA)**. The Tenderers already having valid Digital Signature Certificates are not required to obtain fresh DSC.

II The bids shall be submitted online in the format on the above mentioned website with digital signature.

III The Bidders must ensure that scanned copy of all the documents essential to be enclosed have been attached with the bid form to be submitted online. **All the attachments should be in PDF format.**

IV RSGSM shall not be responsible in any manner for any delay/ failure on the part of Tenderer in online submission of the bids within stipulated date and time.

V All the columns of the lists/ formats / attachments must be filled completely, clearly and in readable form and submitted online.

VI RSGSM shall not be responsible for any failure of bidder in online submission of the bids which may occur due to improper understanding/ compliance of the instructions for online submission.

IMPORTANT POINTS FOR BIDDERS

SUBJECT: **Tender for supply of complete Sugar plant of 1500 TCD (22 hrs. / per day) Expandable to 2500 TCD, to produce premium quality sugar, along with bagasse based Co-Generation power plant of 4.95 MW on Turnkey basis and to provide for one year technical supervision staff.**

Rajasthan State Ganganagar Sugar Mills Ltd. is a reputed profit generating Organization functioning under the direct control of Finance Department of the Govt. of Rajasthan, presently engaged in the business of Production & sale of Sugar, as distillers, manufacturers and dealers in rectified spirit, country liquor and Royal Hetitage Liquor, proposes to establish an **Integrated Sugar Complex at Kaminpura** about 30 KM. away from Sriganganagar City, in Tehsil, Srikaranpur, Distt-Sriganganagar (On Srikaranpur-Sriganganagar Road).

Rajasthan State Ganganagar Sugar Mills Ltd. Jaipur, desires to procure and commission a new **sugar plant of 1500 TCD expandable to 2500 TCD with bagasse based co-generation power plant of 4.95 MW** at **Chak 23 'F', Kaminpura, Distt. Sriganganagar, Rajasthan State** on turnkey basis and invites E-Tenders for:

1. Designing, procuring, manufacturing, supplying and supervision, erection and commissioning and performance of the plant and equipments on turnkey basis as detailed in " Scope of Work " as per annexure - I and in accordance with the terms and conditions of the Contract document.

   To carry out the activities of erection and commissioning of the Plant and equipment as detailed in "Scope of Work" in accordance with the terms and conditions as per Contract document, by the Tenderer having a separate identity as a registered company/partnership/sole proprietorship**.**

2. **Qualification/eligibility criteria for the Tenderers:**

i) The Tenderer should be reputed manufacturer/supplier of complete Sugar plant machinery & equipments.

ii) The Tenderer must have successfully commissioned & performed at least **one** new sugar plant with Co-generation of exportable power to the grid having a capacity not less than 1500 TCD in last **ten** years along with a certificate of successful commissioning of the same by the authorized signatory.

iii) The average annual turn over of the Tenderer shall be at least 100 crores for the last three years, with proof of latest audited balance sheet and certificate from Chartered Accountants.

3. **Earnest Money Deposit(**Bid-Security):-

i) Bid-Security for this turnkey project to be furnished on the estimated cost of Rs. 50 Crores @ of 2% of the estimated value i.e. Rs. 100.00 lacs, out of which 25 lacs through DD and 75 lacs through B.G.from any **scheduled bank**.

ii) Tender without Bid-Security, Tender Fee of Rs. 10,000/- and processing fee of Rs.1000/- shall not be accepted.

4. Last Date & time of downloading of Tender : 04.07.2013, 2:00 PM

5. Tender documents can be obtained **by way of download only** from the official website www.eproc.rajasthan.gov.in (Rajasthan states e-procurement portal) (for each downloaded tender application form a D.D. from any scheduled Bank amounting to Rs. 10,000/- shall be enclosed alongwith the tender documents) in favour of Rajasthan State Ganganagar Sugar Mills Ltd. Payable at Jaipur.

6. Date, time & venue of Pre-Bid Meeting **14.06.2013 12.00 PM**

Venue:- Board Room Rajasthan State Ganganagar Sugar Mills Ltd., 4th floor, Nehru Sahkar Bhawan, Bhawani Singh Road, Jaipur – 302006.

7. Last date & time for submission (online uploading) of Tender : 04.07.2013, 6:00PM

8.(A) Tender alongwith all the documents to be uploaded online only on the website: www.eproc.rajasthan.gov.in

(B) Tender to be addressed to: **Dy.General Manager (P&S) Rajasthan State Ganganagar Sugar Mills Ltd., 4th floor, Nehru Sahkar Bhawan, Bhawani Singh Road, Jaipur – 302006.**

9. The Bid must be valid for one hundred twenty days (120) from the date of opening of Technical Bids.

10. Tender through Email / Fax / Telegram/Postal/ Personal Delivery will not be accepted. RSGSM, assumes no responsibility for any failure in uploading the tender online by the Tenderer**.**

11. This Notice of Tender is an integral part of the enclosed bid document.

12) Tenderer are advised to quote strictly as per the terms and conditions of the tender documents and should not make any deviations / exceptions. Technical Bids shall be opened on 05.07.2013 at 4.00 PM in presence of the Tenderer or their authorized representatives who wish to be present, at the address mentioned above under clause 6.

For and on behalf of The Director Incharge,
Rajasthan State Ganganagar Sugar Mills Ltd. Jaipur

INSTRUCTIONS TO BIDDERS

1. SUBMISSION OF BIDS

1.1 Each tenderer shall submit its bids by uploading online on the website www.eproc.rajasthan.gov.in for Supply of plant, machinery, supervision,erection & commissioning of the same on TURNKEY basis and to provide for one year technical supervision staff.

1.2 The Tenderer must submit (upload online) their Bids in three Documents separately as mentioned in Clause 1.1 above as detailed below.

DOC – I : TECHNICAL BID
DOC – II : FINANCIAL BID
DOC – III : Bid-Security, DD for e –Tender processing fee and tender form fee (This document will be part of DOC-I)

1.2.1 DOC – I : TECHNICAL BID
To contain the following:

Complete set of Tender document duly signed and stamped

Note: Under no circumstances, should Tenderer enter any price in Technical Bid. Financial Bid (Price offer) shall be uploaded through softcopy provided in the e-procurement website. Price offer should not be revealed in any hardcopy document throughout this bidding process.

The above documents shall form one set of the DOC–I Bids. In addition to online submission the Tenderer shall also submit two sets of hard copies of DOC– I Bids, i.e. original and duplicate sets to RSGSM, Head Office, Nehru Sahkar Bhawan, Bhawani Singh Road, Jaipur before last date and time of online submission. Both the sets shall be sealed and marked 'Original DOC– I Bids' and 'Duplicate of DOC– I Bids' on the respective covers and both together sealed in a cover superscribed as:

DOC – I : **TECHNICAL BID** (Original and Duplicate) including of credentials in Proforma as under :

A. General information :

1. Name of the firm :
2. Nature of the firm:
3. Year of establishment :
4. Company Registration No.:
5. Registered Address:
6. Correspondence Address :
   With Tel. & Fax No. & E-mail
7. Address of Branches if any :
8. Address of Workshop:
9. Name & address of Directors & Keypersons, in case of Limited Company

   Name & Address of partners, in case of partnership firm along with Deed and MOU. Telephone, Fax & E-mail for correspondence.

   Name, Address, Telephone, Fax & E-mail for correspondence. of proprietor,

In case of sole proprietary firm:

10. Permanent Account Number :
11. Registration No. of ESI and PF.
12. RST,CST & Service Tax Regestration Certificate (Valid as on Tender Date)
13. Excise Registration No.:
14. Works Contract Registration :
15. Latest Income Tax Clearance Certificate :
16. Current solvency certificate:
17. Name of banker Telephone, Fax & E-mail with full address:
18. Type of account and account No.:
    Whether the firm has any suits/claims pending with tax authorities: (attach details)
19. Company profile with reference to work performance as under:
    a) Nos. of Completed new sugar plants
    b) Nos. of Expansion projects
    c) Name of the Purchasers
    d) Cost of the projects
    e) Dates of Agreements
    f) Dates of commencement of works
    g) Dates of commissioning
    h) Performance certificates shall be enclosed.

Against NIB No :

DUE FOR SUBMISSION ON : 04.07.2013 upto 6:00PM

FOR : Sugar Plant of 1500 TCD Expandable to 2500 TCD with Bagasse Based Co-Generation Power Plant on Trunkey Basis Complete in all respects and to provide for one year technical supervision staff at Chak 23 F Kaminpura Distt. Sri Ganganagar (Rajasthan)

1.2.2 **DOC – II : FINANCIAL BID**

To Contain the following:

'Financial Bid Proforma' **(Financial bid should be submitted online in softcopy as available in online tender document, in the format available on the e-procurement website. In no case the financial offer/ rates should be revealed/ filled in any of the scanned document.)**

DOC – III (This document will be part of DOC-I) : Bid-Security (DD and B.G. for Bid-Security, DD for e-Tendering processing fee and tender form fee, to be scanned, uploaded and original to be submitted on 04.07.2013 upto 6.00 PM in the RSGSM Dy.GM (P & S), Head Office, Jaipur.)

Against NIB No :

FOR : Sugar Plant of 1500 TCD Expandable to 2500 TCD with Bagasses Based Co-Generation Power Plant on Turnkey Basis Complete in all respects and to provide for

one year technical supervision staff at Chak 23 F Kaminpura Distt. Sri Ganganagar (Rajasthan)

2.0 OPENING OF BIDS

2.1 The 'Technical bids' (DOC – I) and Bid-Security (DOC – III) shall be opened on dated 05.07.2013 at 4.00 PM in presence of Tenderer or their authorized representatives who wish to be present at the time of opening.

Financial bids of those Tenderer who qualify on the basis of detailed evaluation of technical bids will be opened later on a date to be specified. The date and time of such opening shall be intimated to Tenderer and the Tenderer or their one authorized representative shall be allowed to attend.

3.0 AMOUNTS TO BE IN FIGURES AND WORDS

3.1 The Tenderer shall quote his price in English both in figures as well as in words. The amounts of Bid offered by the tenderer shall be in the 'Financial Bid Proforma' of the Tender document and duly signed by the Tenderer.

4.0 CORRECTIONS AND ALTERATIONS

4.1 All scanned copies of entries in the Bids shall either be typed or be in ink, erasures and over-writing are not permitted and may render such Bids liable to summary rejection. All corrections and alterations shall be duly attested by the Tenderer with date and seal.

5.0 ALL PAGES TO BE INITIALLED

All pages of the Tender document including drawing shall be initialed with seal at the lower right hand corner or signed with seal wherever required in the Tender documents by the Tenderer or by a person holding power of attorney (copy to be enclosed with DOC – I of Tender) authorizing him to sign on behalf of the Tenderer before submission of Bids. All signatures in Bids documents shall be dated as well.

6.0 ADDENDA/CORRIGENDUM

6.1 The Purchaser may issue Addenda/corrigendum to the Bid documents prior to the date of submission of the Tender to clarify documents or to reflect modifications in the design or contract terms. All such addenda/corrigendum issued shall form part of Bid documents and the purchaser may, at its discretion, extend the deadline for the submission of bids for reasonable time to take the amendment/s into account in preparing the bids.

7.0 BID PRICE TO BE ALL INCLUSIVE

7.1 The Bid price quoted shall be inclusive of all costs including insurance, taxes, duties, transport, erection, commissioning etc. and any claim whatsoever for enhancement of Bid price quoted on any account shall not be entertained. However, the Taxes as have formed part of the Bid shall be paid on actual

production of proof of payment thereof. Any increase/ decrease in rate of taxes after the due date of submission of Bid, shall be given effect to.

7.2 The price quoted should be valid up to the date of successful commissioning of project. The price should be firm and there shall be no increase/escalation of total contract price till commissioning of the project.

8.0 INFORMATION

8.1 The information given in the Bid documents and the plans and drawings forming part thereof is merely intended as general information without any undertaking on the part of the Purchaser as to their accuracy and without obligation relative thereto upon the Purchaser. Before submitting Bids, the Tenderer are advised to inspect the site of work and the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, rules and regulations of Central and State Government Acts governing the construction and operation of the sugar plant & Co-gen. Plant etc. No claim will be entertained later on the grounds of lack of knowledge.

9. ENCLOSURES

9.1 The enclosures to be attached along with DOC- I of the Tender shall include the following besides other such enclosures which may have been specified elsewhere in the Tender documents:

9.1.1 The details i.e. name of each plant, capacity of the plant in TCD, date of Commissioning, mill size and drive details, Co-generation plant with capacity boiler capacity with pressure and temp. TG set capacity with working pressure & temperature, major details of boiling house equipment supplied during last **ten** years.along with successful performance certificate and parameters achieved.

9.1.2 Client' certificate for jobs completed, successful performance and parameters achieved and the contractual payments received for the work done in last **ten** years

9.1.3 Valid PAN, TIN, Excise registration No., Service Tax Registration No., Sales Tax/VAT Registration No. Certificates in true copies / photocopies duly attested by a competent authority.

9.1.4 Power of Attorney or Authority letter (as per annexure No XIV) of the person who has signed the Bids.

9.1.5 Proof of valid registration as turn key supplier with NCDC (if available).

9.1.6 Any other documents required in terms of this notice.

10.0 GENERAL

10.1 The Bids shall be filled complete in all respects and shall be together with requisite information in the manner detailed above. Any Bids incomplete in any respect and violating any of the instructions shall be liable to be rejected. If the

space in the Bids or any schedule or Performa is insufficient, pages may be separately added and numbered.

10.2 Tenderers must submit one consolidated tender for supply, erection & commissioning on turnkey basis.

10.3. **Financial Bid Evaluation criteria:** The financial evaluation/ comparision shall be based on the sum of the total price **quoted** (for the Supply, Erection, Commissioning & to provide for one year Technical Supervision Staff) Including all costs and all taxes, duties, insurance, transportation and loading/unloading etc. applicable to the bidder as per law of the Central/ State Government/ local authorities, which will be the price for comparison and placement of orders. However, the Taxes will be paid on production of documentary proof of payment to the Government/ Authority by the seller. Further that any increase/ decrease in the rates of taxes after the due date of submission of the bid shall be given effect to. The Contract Price will be F.O.R. at site including taxes as quoted in Price Proforma.

10.4 The acceptance of Bids will rest with the Purchaser and it is not binding on the purchaser to accept the lowest Bids or any of the Bids. The purchaser reserves the rights to reject any or all the Bids without assigning any reason thereof.

10.5 The overall responsibility for satisfactory supply, erection and commissioning shall be strictly of the Tenderers only and they will ensure the proper workmanship in supply, erection & commissioning & successful performance. They shall have to undertake guarantee for the same as stipulated in the **tender/ a**greement.

10.6 Conditional Bids and Bids which are incomplete and otherwise considered defective and not in accordance with the Bid conditions, specification, etc are liable to be rejected.

10.7 If the Tenderer deliberately gives wrong information in his Bids, the Purchaser reserves the right to reject such Bids at any stage or to cancel the contract, if awarded and forfeit Bid security / Performance Security-I and II.

10.8 Canvassing in any form in connection with the Bids is strictly prohibited and the Bids submitted by the Tenderer who resort to canvassing are liable for rejection.

10.9 Should a Tenderer or in the case of a firm or Company one or more of its partners / shareholders holding more than 20% shares in the company/ directors have a relation or relations, employed in the capacity of an officer of the Purchaser, the authority inviting Bids shall be informed of the fact alongwith detail of the officer. Failing this, the Purchaser may, at its sole discretion, reject the Bids or cancel the contract and forfeit the Bid security / Performance Security-I and II.

10.10 The Bids submitted by a Tenderer shall become property of the Purchaser who shall have no obligation to return the same to the Tenderer.

10.11 The Purchaser shall not be liable for any expenses incurred by the Tenderer in the preparation and submission of the Bids irrespective of whether the Bids is accepted or not.

10.12 Other facilities, if any, provided by the purchaser to the seller beyond the provisions of Agreement, charges of such facilities shall be recovered from the Seller.

10.13 The Tenderer shall have to carefully study and understand the conditions, specifications, size, make etc. of the goods to be supplied. If there is any doubt about the meaning of any terms, conditions or specifications etc. then it should refer to the Dy. G.M. (P&S)- Jaipur,RSGSM and get clarification. The decision of the Purchaser regarding interpretation of the conditions and specifications shall be final and binding on the Tenderers.

10.14 Tenderers are hereby explicitly warned that the Individuals signing the Tender must specify as follows:-

a. Whether signing as sole proprietor of the firm.

b. Whether signing as registered active partner of the firm.

c. Whether signing for the firm as an authorized signatory.

d. Incase of companies and registered firms whether signing as secretary, manager, Partner, Director, etc. will submit an authorization from the company to do this. A copy of any document under which such authority is given should be forwarded with the tender, if a copy has not already been sent to the Purchaser already.

10.15 Only such Tenderers who are bonafide Manufacturers/suppliers as per eligibility criteria mentioned in the BID document shall be eligible.

10.16 No tenderer, who is not registered under the Sales Tax Act, prevalent in the State where his business is located, will be eligible for Tender. The Sales Tax Registration numbers should invariably be quoted.

10.17 Conditional tenders will not be accepted. If a Tenderer imposes conditions in addition to or in conflict with the conditions mentioned herein, his Tender may be rejected.

10.18 The rates quoted should be F.O.R. destination at Integrated Sugar Mills site including all Taxes. Any increase in rates of Excise duty or any other Tax imposed by Central Govt. or State Govt. after the due date of the submission of Tender will be paid extra. Similarly any reduction in the Excise duty and any other Tax after the due date of Tender will be paid less to the Party. In case of delay in supply, increase in excise duty/ any other taxes shall be borne by the tenderer

10.19 No counter condition shall be accepted.

10.20 The Seller shall not Assign or Sublet his contract as a whole.

Assignment: the Tenderer shall not assign the benefit of the contract in whole under the contract. A charge in favour of the Tenderer's bankers of any monies due under the contract, or the subrogation of insurers to the Tenderer's rights, shall not be considered an assignement.

Sub contracting: The contractor shall not sub-let the contract as a whole. Sub-contrcting shall on no account absolve the contractor of its obligations under the contract, including performance obligations. The conractor shall be responsible for the acts, defaults and neglects of any sub-contrator, its agents, servants or workmen as fully as if they were the acts, defaults or neglects of the contractor, its agents, servants or workmen.

10.21 The Tenderer should Sign the Tender Form at the end of each page as token of his acceptance of all the terms and conditions of the Tender.

10.22 The Tender must be accompanied by an Bid Security/ Earnest Money equivalent to 2% of the estimated value, exact Bid-Security i.e. Rs.1.00 Crore (Rs. 100.00 lacs), out of which 25 lacs through DD and 75 lacs through B.G. from any **scheduled bank**, without which the Tender shall not be considered.

10.23 Tenders shall be submitted online only.

10.24 Bid validity shall be for a period of 120 days from the last date of opening of Technical Bid or for extended period as per clause 16.2.

10.25 After the Tender has been accepted, the rates shall remain valid through out the contract period (upto satisfactory performance trial of Plant & Machinery).

10.26 The Tenderer shall be responsible for the proper packing of goods so as to avoid damages under normal conditions of transport by road, sea, rail or air and delivery of the material in good condition to the consignee at destination (Factory site).

10.27 When the performance Security-I in full or in part is proposed to be forfeited, a notice will be given to the Tenderer to explain within 15 days as to why the performance Security-I should not be forfeited for failure to complete the supplies and get the work done in time.

10.28 In the event of any breach of conditions of the contract at any time on the part of the Tenderer, the contract may be terminated summarily by the Director Incharge with such conditions as may be deemed fit.

10.29 The mode of payment shall be according to special conditions of contract mentioned herein.

10.30 Remittance charges on payment made to firms through cheques/RTGS etc. will be borne by the successful tenderer/contractor.

10.31 All legal proceedings, arising out of this contract shall be subject to the jurisdiction of the courts situated at Jaipur City only.

10.32 Direct or indirect canvassing on the part of Tenderers or their representatives will disqualify them.

10.33 In case of any dispute arising out of or in relation to any matter related to the tender/contract/ agreement and any dispute related to any of the bank guarantees under this tender/contract/agreement , the matter will be referred to Sole Arbitrator appointed by Director Incharge, RSGSM whose decision shall be final and binding on both the parties. This reference to the Arbitrator shall be

deemed to be a reference under the provisions of the Arbitration and Conciliation Act, 1996 and the rules made thereunder and any statutory modifications and re-enactments thereof that may be made from time to time and actually in force at the time of reference. The place of arbitration shall at be Jaipur only.

10.34

i) The Purchaser reserves the right to accept any tender not necessarily the lowest, reject any tender without assigning any reasons.

(ii) If the tenderer resiles from his offer or offers new terms after opening of the tender, his Bid-Security is liable to be forfeited.

(iii) The submission of more than one tender and under different names is prohibited.

(iv) Any relationship or business connection that may exist between the Tenderer and any official of the Rajasthan State Ganganagar Sugar Mills Ltd., should be declared. If this information is found to have been suppressed, then Contract, if any, entered into may be cancelled forthwith without notice and compensation and any amount which may have been deposited shall be forfeited.

Signature and Seal of Tenderer

11 CLARIFICATION OF BID DOCUMENTS

11.1 Prospective Tenderers requiring any further information or clarification on the bid documents may notify in writing at the E-mail address **rsgsmlimited@yahoo.com** or may be faxed at 01412740676**.**

11.2 A pre-bid meeting of all prospective Tenderers will be held at the address, date & time indicated in 'Notice Inviting Bid' to clarify and answer queries of the Tenderers.

11.3 The Purchaser's response (including an explanation of the queries) will be sent in writing or through email to all prospective Tenderer's & will also be uploaded on RSGSM website **www.rsgsm.in**

12.0 AMENDMENT OF BID DOCUMENTS

12.1 At any time prior to the deadline for submission of bids, the Purchaser may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Tenderer, modify the bid documents by amendment/ corrigendum/addenda.

12.2 The amendment, which shall be part of the Bid Document, will be notified only online on the E-procurement portal i.e. **www.eproc.rajasthan.gov.in.**

12.3 In order to afford prospective Tenderer reasonable time to take the amendment/s into account in preparing their bids, the purchaser may, at its discretion, extend the deadline for the submission of bids.

13.0 LANGUAGE OF BID

13.1 The bid prepared by the Tenderer, and all correspondence and documents relating to the bid exchanged by the Tenderer and/or the purchaser, shall be written in the English language.

14.0 BID CURRENCIES

14.1 Prices shall be quoted in Indian Rupee only.

15.0 BID SECURITY

15.1 The Tenderers shall furnish, as part of their Bid, a Bid security of an amount mentioned as under:

i) Bid-Security to be furnished @ 2% of the total estimated value for Supply, Supervision, erection, commissioning and performance of Plant & Machinery at integrated sugar complex at Kaminpura (Sriganganagar).

15.2 Successful Tenderer shall have to deposit **Performance Security-I** of an amount equal to 5% of total contract price including taxes, duties as quoted **(in addition to BG-III)**. The amount deposited against Bid security will be adjusted in this account. The Security is to be deposited by way of DD / Pay Order/ Bank Guarantee from scheduled bank in favour of The Rajasthan State Ganganagar Sugar Mills Ltd., within 15 days from the date of issue of LOI. The validity of this BG shall be for 3 years. The LOI issued to the successful tenderer shall form the part of the agreement. Non submission of performance security-I shall lead to cancellation of the BID and forfeiture of EMD/BID Security.

The performance Security-I will be refunded after successful performance of plant & machinery for two consequent crushing season in all respect as per Annexure XVIII and Annexure III, after successful trial, and succesful performance of Co-Gen. Power Plant for two years atleast 236 days in each year or 24 months from commissioning and also faithful execution of the contract in due time as per PERT chart, without any interest on the amount of Performance security deposited. If the tenderer fails to deposit the required security amount within the period specified, such failure will be treated as breach of the terms & conditions of the tender and will result in the forfeiture of the Bid security of the tender at the discretions of the Director In charge for reasons to be recorded.

That all the machinery & equipment will be brand new of latest design and first class material and workman ship. Any part found defective within 24 months from the date of commissioning of the project shall be replaced or rectified by the seller free of cost. Even after rectification, due to either faulty design, poor workmanship or use of defective material, if the plant/ machinery/ equipment or part thereof is found un-satisfactory then in such an eventuality the purchaser will be entitled to forfeit Performance Security-I (partly or wholly) as may be determind by the purchaser.

15.3 Any Bid submitted without Bid security in accordance with clause 15.1 above will be rejected by the purchaser.

15.4 Bid security of unsuccessful Tenderers will be discharged or returned promptly upon signing of the agreement with the successful Tenderer, but in any event not later than hundred twenty (120) days after the expiry of period of bid validity prescribed by the purchaser, pursuant to Clause 16.

15.5 The Bid security of successful Tenderer will be adjusted in performance Security-I as mentioned in clause 15.2.

15.6 The Bid security will be forfeited:

a. If successful Tenderer withdraws/modify its Bid during the period of bid validity as specified in clause 16.

b. In case of successful Tenderer, if the Tenderer fails:
   i) To sign the Contract in accordance with clause 18.
   ii) To furnish the performance Security-I in accordance with Terms and conditions.
   iii) To commence the supply of the goods or services or execute work as per supply/work order within the time specified.
   iv) If the bidder breaches any provision of code of integrity prescribed for bidder specified in the Act.

16.0 PERIOD OF VALIDITY OF BIDS

16.1 Bids shall remain valid for a period of one hundred twenty days (120) from the date of opening of Technical Bids. Bids which are submitted with a validity period shorter than 120 days or fail to mention the validity period shall be treated as non- responsive and shall be rejected.

16.2 Notwithstanding clause 16.1 above, the Purchaser may solicit Tenderer's consent to an extension of the period of bid validity. The request and the responses there to shall be made in writing (or by email). If the Tenderer agrees to the extension request, the validity of the Bid Security provided under clauses15.1 shall also be suitably extended. However Tenderer can refuse the request to extend the period of validity without forfeiting his bid security. A Tenderer agreeing to the request to extend the validity period however will not be permitted to modify his bid.

17.0 Letter Of Intent (LOI)

17.1 The Purchaser will notify the successful Tenderer in writing by letter, or by email the acceptance of the bid(LOI).

17.2 The Letter Of Intent (LOI)/acceptance of bid will constitute the formation of a contract, until the contract/agreement has been effected pursuant to clause 18.

18.0 SIGNING OF CONTRACT/AGREEMENT

18.1 At the time of issue of LOI, the Purchaser will send the successful Tenderer the 'Form of Contract' provided in the Tender document, containing all clauses of Terms and Conditions between the parties.

18.2 Unless extended within fifteen (15) days of acceptance of LOI, the successful Tenderer shall sign with date and seal the Contract/agreement jointly with the purchaser and return it to the purchaser or if deemed proper the purchaser may call the successful Tenderer to sign the agreement at Purchaser Head Office at Jaipur. The signing of agreement shall take place only after submission of the required document not submitted with the bid. On behalf of the successful Tenderer the agreement shall be signed only by the authorized signatory in whose favour the valid authority has been issued (copy need to be attached).

18.3 The **'Agreement'** between the purchaser and successful Tenderer shall be effective from the date of signing it by the **successful tenderer** and purchaser.

19.0 PERFORMANCE SECURITY-II :-

Within one eighty days (180) signing of the agreement, the successful bidder shall furnish the '**Performance Security (BG-III)**, in accordance with the conditions of contract, provided in **annexure VI** of the bid document.

20.0 The Law relating to procurement "'The Rajasthan Tarnsparency in Public Procurement Act, 2012" {hereinafter called the Act} and the "Rajasthan Public Procurement Rules, 2013" {hereinafter called the Rules} under the said Act have come into force which are available on the website of state public Procurment Portal http:/sppp.raj.nic.in. Therefore, the Bidders are advised to acquaint themselves with the provisions of the Act and the Rules before participating in the Bidding process. If there is any discrepancy between the provisions of the Act and the Rules and this Bidding Document, the provisions of the Act and the Rules shall prevail.

20.1 Tendrer/Seller shall comply with direction for public procurement given by Finance Department Rajasthan as under :-

Annexure A : Compliance with the Code of Integrity and No Conflict of Interest

Any person participating in a procurement process shall -

(a) not offer any bribe, reward or gift or any material benefit either directly or indirectly in exchange for an unfair advantage in procurement process or to otherwise influence the procurement process;
(b) not misrepresent or omit that misleads or attempts to mislead so as to obtain a financial or other benefit or avoid an obligation;
(c) not indulge in any collusion, Bid rigging or anti-competitive behavior to impair the transparency, fairness and progress of the procurement process;
(d) not misuse any information shared between the procuring Entity and the Bidders with an intent to gain unfair advantage in the procurement process;
(e) not indulge in any coercion including impairing or harming or threatening to do the same, directly or indirectly, to any party or to its property to influence the procurement process;
(f) not obstruct any investigation or audit of a procurement process;
(g) disclose conflict of interest, if any; and
(h) disclose any previous transgressions with any Entity in India or any other country during the last three years or any debarment by any other procuring entity.

Conflict of Interest:-

The Bidder participating in a bidding process must not have a Conflict of Interest.

A Conflict of Interest is considered to be a situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations.

i. A Bidder may be considered to be in Conflict of Interest with one or more parties in a bidding process if, including but not limited to:

a. have controlling partners/ shareholders in common; or
b. receive or have received any direct or indirect subsidy from any of them; or
c. have the same legal representative for purposes of the Bid; or
d. have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Procuring Entity regarding the bidding process; or
e. the Bidder participates in more than one Bid in a bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the

Annexure B : Declaration by the Bidder regarding Qualifications

Declaration by the Bidder

In relation to my/our Bid submitted to ..... for procurement of ..... in response to their Notice Inviting Bids No..... Dated..... I/we hereby declare under Section 7 of Rajasthan Transparency in Public Procurement Act, 2012, that:

1. I/we possess the necessary professional, technical, financial and managerial resources and competence required by the Bidding Document issued by the Procuring Entity;
2. I/we have fulfilled my/our obligation to pay such of the taxes payable to the Union and the State Government or any local authority as specified in the Bidding Document;
3. I/we are not insolvent, in receivership, bankrupt or being wound up, not have my/our affairs administered by a court or a judicial officer, not have my/our business activities suspended and not the subject of legal proceedings for any of the foregoing reasons;
4. I/we do not have, and our directors and officers not have, been convicted of any criminal offence related to my/our professional conduct or the making of false statements or misrepresentations as to my/our qualifications to enter into a procurement contract within a period of three years preceding the commencement of this procurement process, or not have been otherwise disqualified pursuant to debarment proceedings;
5. I/we do not have a conflict of interest as specified in the Act, Rules and the Bidding Document, which materially affects fair competition;

Date:
Place:

Signature of bidder
Name :
Designation:
Address:

Annexure C : Grievance Redressal during Procurement Process

The designation and address of the First Appellate Authority is _____

The designation and address of the Second Appellate Authority is _____

(1) Filing an appeal

If any Bidder or prospective bidder is aggrieved that any decision, action or omission of the Procuring Entity is in contravention to the provisions of the Act or the Rules or the Guidelines issued thereunder, he may file an appeal to First Appellate Authority, as specified in the Bidding Document within a period of ten days from the date of such decision or action, omission, as the case may be, clearly giving the specific ground or grounds on which he feels aggrieved:

Provided that after the declaration of a Bidder as successful the appeal may be filed only by a Bidder who has participated in procurement proceedings:

Provided further that in case a Procuring Entity evaluates the Technical Bids before the opening of the Financial Bids, an appeal related to the matter of Financial Bids may be filed only by a Bidder whose Technical Bid is found to be acceptable.

(2) The officer to whom an appeal is filed under para (1) shall deal with the appeal as expeditiously as possible and shall endeavour to dispose it of within thirty days from the date of the appeal.

(3) If the officer designated under para (1) fails to dispose of the appeal filed within the period specified in para (2), or if the Bidder or prospective bidder or the Procuring Entity is aggrieved by the order passed by the First Appellate Authority, the Bidder or prospective bidder or the Procuring Entity, as the case may be, may file a second appeal to Second Appellate Authority specified in the Bidding Document in this behalf within fifteen days from the expiry of the period specified in para (2) or of the date of receipt of the order passed by the First Appellate Authority, as the case may be.

(4) Appeal not to lie in certain cases

No appeal shall lie against any decision of the Procuring Entity relating to the following matters, namely:-

(a) determination of need of procurement;
(b) provisions limiting participation of Bidders in the Bid process;
(c) the decision of whether or not to enter into negotiations;
(d) cancellation of a procurement process;
(e) applicability of the provisions of confidentiality.

(5) Form of Appeal

(a) An appeal under para (1) or (3) above shall be in the annexed Form along with as many copies as there are respondents in the appeal.
(b) Every appeal shall be accompanied by an order appealed against, if any, affidavit verifying the facts stated in the appeal and proof of payment of fee.

Doc1

(c) Every appeal may be presented to First Appellate Authority or Second Appellate Authority, as the case may be, in person or through registered post or authorised representative.

(6) Fee for filing appeal

(a) Fee for first appeal shall be rupees two thousand five hundred and for second appeal shall be rupees ten thousand, which shall be non-refundable.

(b) The fee shall be paid in the form of bank demand draft or banker's cheque of a Scheduled Bank in India payable in the name of Appellate Authority concerned.

(7) Procedure for disposal of appeal

(a) The First Appellate Authority or Second Appellate Authority, as the case may be, upon filing of appeal, shall issue notice accompanied by copy of appeal, affidavit and documents, if any, to the respondents and fix date of hearing.

(b) On the date fixed for hearing, the First Appellate Authority or Second Appellate Authority, as the case may be, shall,-

(i) hear all the parties to appeal present before him; and

(ii) peruse or inspect documents, relevant records or copies thereof relating to the matter.

(c) After hearing the parties, perusal or inspection of documents and relevant records or copies thereof relating to the matter, the Appellate Authority concerned shall pass an order in writing and provide the copy of order to the parties to appeal free of cost.

(d) The order passed under sub-clause (c) above shall also be placed on the State Public Procurement Portal.

FORM No. 1
[See rule 83]

Memorandum of Appeal under the Rajasthan Transparency in Public Procurement Act, 2012

Appeal No .....of .....

Before the ..... (First / Second Appellate Authority)

1. Particulars of appellant:

(i) Name of the appellant:

(ii) Official address, if any:

(iii) Residential address:

2. Name and address of the respondent(s):

(i)

(ii)

(iii)

3. Number and date of the order appealed against and name and designation of the officer / authority who passed the order (enclose copy), or a statement of a decision, action or omission of the Procuring Entity in contravention to the provisions of the Act by which the appellant is aggrieved:

4. If the Appellant proposes to be represented by a representative, the name and postal address of the representative:

5. Number of affidavits and documents enclosed with the appeal:

6. Grounds of appeal:

.....

.....

..... (Supported by an affidavit)

7. Prayer:

.....

.....

.....

Place .....

Date .....

Appellant's Signature

Annexure D : Additional Conditions of Contract

1. Correction of arithmetical errors

Provided that a Financial Bid is substantially responsive, the Procuring Entity will correct arithmetical errors during evaluation of Financial Bids on the following basis:

i. if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Procuring Entity there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;
ii. if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
iii. if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (i) and (ii) above.

If the Bidder that submitted the lowest evaluated Bid does not accept the correction of errors, its Bid shall be disqualified and its Bid Security shall be forfeited or its Bid Securing Declaration shall be executed.

2. Procuring Entity's Right to Vary Quantities

(i) At the time of award of contract, the quantity of Goods, works or services originally specified in the Bidding Document may be increased or decreased by a specified percentage, but such increase or decrease shall not exceed twenty percent, of the quantity specified in the Bidding Document. It shall be without any change in the unit prices or other terms and conditions of the Bid and the conditions of contract.

(ii) If the Procuring Entity does not procure any subject matter of procurement or procures less than the quantity specified in the Bidding Document due to change in circumstances, the Bidder shall not be entitled for any claim or compensation except otherwise provided in the Conditions of Contract.

(iii) In case of procurement of Goods or services, additional quantity may be procured by placing a repeat order on the rates and conditions of the original order. However, the additional quantity shall not be more than 25% of the value of Goods of the original contract and shall be within one month from the date of expiry of last supply. If the Supplier fails to do so, the Procuring Entity shall be free to arrange for the balance supply by limited Bidding or otherwise and the extra cost incurred shall be recovered from the Supplier.

3. Dividing quantities among more than one Bidder at the time of award (In case of procurement of Goods)

As a general rule all the quantities of the subject matter of procurement shall be procured from the Bidder, whose Bid is accepted. However, when it is considered that the quantity of the subject matter of procurement to be procured is very large and it may not be in the capacity of the Bidder, whose Bid is accepted, to deliver the entire quantity or when it is considered that the subject matter of procurement to be procured is of critical and vital nature, in such cases, the quantity may be divided between the Bidder, whose Bid is accepted and the second lowest Bidder or even more Bidders in that order, in a fair, transparent and equitable manner at the rates of the Bidder, whose Bid is accepted.

UNDERTAKING FOR FINANCIAL BID OFFER

To

Rajasthan State Ganganagar Sugar Mills Ltd. 4th Floor, Nehru Sahkar Bhawan, Bhawani Singh Road, Jaipur-302006, Rajasthan

SUB.: Bid for design, manufacture, procure, supply,supervision, Erection and Commissioning and performance of Plant and equipment including services as specified in Annexure no. I of Tender document of sugar plant of 1500 TCD expandable to 2500 TCD with 4.95 MW co-generation power plant and to provide for one year technical supervision staff.

1. We have examined the complete Tender Document with all Annexures the receipt of which is hereby duly acknowledged.

2. We, the undersigned, offer to design, manufacture, supply, performance of Plant and equipment including services, Erection & Commissioning as specified in Annexure – I of Tender document in conformity with the said Tender Document, including Addenda Nos., (_____) (if any).

3. If our Bid is accepted, we undertake to commission all the Plant and Equipment items as per specifications and time schedule given in the tender document/ agreement, the time to be calculated from the date of signing of Agreement.

4. If our Bid is accepted, we will provide the Performance Security for the due performance of the Contract and Plant and equipment supplied by us under the said Contract in accordance with the terms and conditions of the Contract.

5. We understand that you reserve to yourself the right to accept or reject this Bid whether it is lower, the same or higher than any other Bid, or for any other reason whatsoever.

6. We undertake to do any extra work not covered by the above Financial Bid Proforma which may be ordered by the 'Purchaser' and hereby agree that the value of such extra work shall be determined as provided for in the 'Terms and Condition' of the Contract or as mutually agreed.

7. We agree to abide by this Bid for the period of 120 days from the Opening of **Technical Bids** or extended date pursuant to Clause 16 of the instruction to Tenderer, and it shall remain binding on us for that period.

8. Until a formal Contract is executed, the letter of acceptance or letter of intent shall constitute a binding contract.
9. All correspondence related to this Bid is to be addressed to the undersigned (Tenderer) at the following address (also give phone & fax nos., mobile no. and email id):

_____

_____

_____

Dated this _____ day of _____2013

(Signature)
(In the Capacity of)

Duly authorized to sign Bid for and on behalf of

Witness (signature of Witness with address)

TERMS AND CONDITIONS OF THE CONTRACT
INDEX

Clause No.:

DEFINITIONS AND INTERPRETATIONS

1. In construing the Contract the following words and Expressions shall have the following meanings hereby assigned to them;

1.1 'Purchaser' means **Rajasthan State Ganganagar Sugar Mills Ltd. 4th Floor, Nehru Sahkar Bhawan, Bhawani Singh Road, Jaipur-302006, Rajasthan**, and the legal successors in title to the Purchaser but any assignee of the Purchaser.

1.2 'Seller' / 'Supplier' / contractor means M/s. (name of plant & machinery supplier) India, whose Tender has been accepted by the Purchaser and legal successor in title to the Seller but not any assignee of the Seller.

1.3 'Sub-Seller' means any person/ party (other than the Seller) named in the contract or otherwise for the supply of any part of the Plant and equipment or any person/ party to whom any part of the contract has been sub-let with the consent in writing of the Purchaser and the sub Seller's legal successors in title, but not any assignee of the sub- Seller.

1.4 'Purchaser's Representative' means any assistant of the Purchaser appointed from time to time to perform the duties delegated to him under clause 2.0 (Purchaser and Purchaser's Representative) hereof.

1.5 'Conditions' means Terms and Conditions contained in bid document and agreement.

1.6 'Contract' / 'Agreement' means the agreement between the Purchaser and the Seller (howsoever made) for the supply of the Plant and equipment including the Form of Contract, the terms and conditions, Bid Document, Scope of Work and the drawings (if any) annexed thereto and such schedules, annexure etc. as are referred to therein and in the Tender document.

1.7 'Contract Price' mean the sum stated in the Contract as the price payable to the Seller for the supply of the Plant and equipment and erection and commissioning of the Plant and equipment However the CST and Excise Duty, shall be adjusted to give effect to such amounts as these are payable by the Purchaser to the Seller on actual basis.

1.8 'Cost' means all expenses and costs incurred including overhead and financing charges properly allocable thereto with no allowance for profit.

1.9 'Bid' / 'Tender' means the Tenderer's priced offer to the Purchaser for the Supply of the Plant and equipment and erection and commissioning thereof.

1.10 'Dispatch' means Plant and equipment dispatched to the sugar mill site of the 'Purchaser'**, Rajasthan State Ganganagar Sugar Mills Ltd, At Chak 23 'F' Village Kaminpura, Dist. Sri Ganganagar, Rajasthan,** on F.O.R. basis.

1.11 'Commissioning' means to design, manufacture, supply of Plant and equipment (including services), and supervision, erection and commissioning including no load trial,water trial, steam trial, vacuum trial and full load actual operation till

successful performance of the plant for start of commercial production thereof at the mill's site.

1.12 'Time for Commissioning' means the period of time for Commissioning (as defined in Clause 1.11) of the Plant and equipment (including services) as agreed and specified in agreement or as extended under Sub-Clause 13.1 (Extension of Time for Commissioning) calculated from the date of Agreement and not as a consequence of any default by the Seller.

1.13 'Plant and equipment' means machinery, apparatus, materials, articles and things of all kinds to be provided under the contract as fully detailed in specifications.

1.14 'Programme' means the programme referred to in clause 9 (*Programme*).

1.15 'Specification' means the technical specification of the Plant and equipment annexed to or included in the contract/agreement/bid document.

1.16 'Test' means the tests specified in the Annexure **XVIII** of the Tender document / contract (or otherwise agreed by the Purchaser and the Seller) which are to be conducted by the Seller upon the Plant and equipment before/after Dispatch and Commissioning, as the case may be.

1.17 "Defects Liability period' has the meaning assigned by Clause 16 (Defects Liability).

1.18 'Annexure' means the Annexure to terms and conditions of the Contract/Bid document.

1.19 'Writing' means any hand-written, typewritten or printed statement.

1.20 'Day' means Calendar Day.

1.21 'Week' means any period of 7 days.

1.22 'Month' means calendar month.

1.23 "LOI" (Letter Of Intent) means the letter communicating intension of formal acceptance of the price bid by the purchaser.

1.24 "Performance Guarantee Period" is as mentioned in clause 17.2.

1.24(A) Warranty- The seller shall warrantee that all material & equipment supplied by seller or sub-seller will be brand new (fresh) & conforming to the standard specification & performance specified in this agreement. The warrantee shall mean that the seller shall replace, repair, modify at seller's own cost the plant, machinery, equipment, material which are found to be not in conformity with any of the specifications, standard and performance parameters upto the satisfaction of the purchaser.

1.25 Interpretations.
Words importing persons or parties shall include firms, corporations and any entity having legal capacity.

1.26 Singular and plural Words importing the singular only also include the plural and vice versa where the context requires.

1.27 Notice and consents

Wherever in these conditions provision is made for giving notice or consent by any person, unless otherwise specified such notice or consent shall be in writing and the word 'notify' shall be construed accordingly. Unless specifically so stated any consent required of a party or the Purchaser shall not be unreasonably withheld.

1.28 Heading and Marginal notes

The headings or marginal notes in the Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.

1.29 Bidder/Tenderer:- "Bidder" shall mean a separate Identity/registered firm, Company/ Partnership/sole propiretership who are participating in this tender .

1.30 Bid-Security :-"Bid-Security" means Earnest Money Deposited as clause 3 of notice inviting tender.

1.31 Invitation of Bid:- "Invitation of Bid" means the advertisement published in accordance with the legal requirements or public notice or by other means to prospective Bidders of the forthcoming opportunity to Bid.

1.32 Payment :- "Payment" shall mean the amount payable by the purchaser to the seller.

1.33 Notification :- "Notification" Shall mean and include all orders, directives and intimations issued by the Government in Official Gazette.

1.34 Power of Attorney/:- Means a document executed on the prescribed non-judicial stamp paper, duly notarized, as per the law in the respective state/country.

1.35 Performance:- Security-I Means the unconditional Bank Guarantee/DD that provides protection to the purchaser (RSGSM) for the completion of the contract.

1.36 Successful Bidder/:- Prior to the signing of Agreement, the Bidder whose Tender has been accepted by the RSGSM,shall be Known as successful Bidder.

1.37 Tender Document:- Means this tender document.

1.38. BG-I :- First Advance: Bank guarantee of a schedule bank against first advance to be paid to seller for entire scope of supply of plant and machinery as per agreement.

BG-II :- Second Advance: Bank guarantee of a schedule bank against second advance to be paid to seller on submission of prescribed documents, for entire scope of supply of Plant and Machinery as per agreement.

BG-III:- Bank guarantee of a schedule bank against performance security-II as prescribed in the agreement /bid and shall have to be submitted within 180 days after signing of the agreement/contract.

This is in addition to performance security-I which is 5% of Contract Price and performance security-I is to be submitted within 15 days from LOI.

2.0 PURCHASER AND PURCHASER'S REPRESENTATIVE

2.1 Purchaser's Duties

The Purchaser shall have and carry all the rights, powers and duties set out in this Agreement.

2.2 Purchaser's representatives

The Purchaser's Representative shall be responsible to the Purchaser and shall watch, supervise, test and examine any Plant and equipment or workmanship employed in connection therewith, including under Sub- Clause 2.3 *(Purchaser's Power to Delegate)*.

2.3 Purchaser's power to delegate

The Purchaser may from time to time delegate to the Purchaser's Representative any of his duties and he may at any time revoke such delegation.

Any delegation or revocation shall be in writing. The Purchaser shall furnish to the Seller a copy of any such delegation or revocation. No such delegation or revocation shall have effect until a copy thereof has been delivered to the Seller.

Any written decision, instruction, order or approval given by the Purchaser's Representative to the Seller in accordance with such delegation shall have the same effect as though it had been given by the Purchaser and for the avoidance of doubt shall bind the Purchaser.

If the Seller disputes or questions any decision, instruction or order of the Purchaser's Representative, he may refer the matter to the Purchaser who shall confirm, reverse or vary the decision in accordance with Sub-Clause 2.6 (*Disputing Purchaser's Decisions, Instructions and Orders).*

2.4 Purchaser's Decisions and Instructions

The Seller shall proceed with the Contract in accordance with the decisions, instructions and orders given by the Purchaser in accordance with these Conditions.

2.5 Confirmation in writing

The Seller shall require the Purchaser to confirm in Writing any decision, instruction or order of the Purchaser which is not in writing. The Seller shall make such request without undue delay. Such a decision, instruction or order shall not be effective until written confirmation thereof has been received by the Seller.

2.6 disputing Purchaser's Decision, Instructions and Orders

If the Seller by notice to the Purchaser, within 10 days after receiving any decision, instruction or order of the Purchaser in writing or written confirmation thereof under sub-clause 2.5 (*Confirmation in Writing*), disputes or questions the same, giving his reasons for so doing, the Purchaser shall within a further period of 10 days by notice to the Seller, the Purchaser with reasons, confirm, reverse or vary such decision, instruction or order.

2.7 Purchaser to act fairly

Wherever by the Conditions the Purchaser is required to exercise his discretion:

- by giving his decision, opinion or consent
- by expressing his satisfaction or approval
- by determining value
- or otherwise by taking action which may affect the rights and obligations of either of the parties

He shall exercise such discretion fairly within the terms of the Contract and having regard to all the circumstances.

2.8 One representative each from the Seller and Purchaser shall constitute the Dispute Resolution Committee (DRC) which shall meet as and when required during the contract period in order to resolve all operational disputes that may arise from time to time during the contract execution. Purchaser's decision shall prevail in these meetings. Disputes not settled by the DRC may be referred for Arbitration under Clause 30.

2.9 The Seller shall notify the Purchaser in writing of any addition to their scope of work that has a cost implication to the Contract that may arise during the execution of Contract. The Purchaser's representative shall thoroughly examine such notice and recommend to the Purchaser of the need to amend the total Contract price awarded to the Seller and communicate to the Seller about the Purchaser's decision. If the change in scope warrants a price revision, the Purchaser shall issue an order with the copies to all parties concerned informing the amendment in price. In the event of any disagreement the same may be referred to the DRC as cited in Clause 2.8.

3.0 ASSIGNMENT AND SUB-CONTRACTING

The Seller shall not Assign or Sublet his contract as a whole.

3.1 **Assignment:** the Tenderer shall not assign the benefit of the contract in whole under the contract. A charge in favour of the Tenderer's bankers of any monies due under the contract, or the subrogation of insurers to the Tenderer's rights, shall not be considered an assignement.

3.2 **Sub contracting:** The contractor shall not sub-let the contract as a whole. Sub-contrcting shall on no account absolve the contractor of its obligations under the contract, including performance obligations. The conractor shall be responsible for the acts, defaults and neglects of any sub-contrator, its agents, servants or workmen as fully as if they were the acts, defaults or neglects of the contractor, its agents, servants or workmen.

4.0 PERFORMANCE SECURITY-II :-

4.1 The Seller shall provide the Performance Security for due performance of the Contract and the guaranteed performance of the plant and equipment supplied and commissioned by the Seller in following manner:-

Performance Security-II (B.G.-III) by way of bank guarantee within One Hundred Eighty (180) days, from the signing of agreement, issued by scheduled bank for the due Performance of the Contract and the guaranteed performance of the Plant and equipment supplied and commissioned by the Seller. The terms of the guarantee shall be in the form annexed hereto. Such guarantee shall be invoked if Seller fails to complete the work under the Contract and in the events stipulated under clauses 16 (Defects Liability), 17 (Warranty and Performance Guarantee), 20 (Liquidated Damages) and failure to comply with Clause 4.2. The Guarantee shall be provided at the Seller's own cost.

The value of the guarantee will be 5% of total contract price including taxes, duties as quoted) will be released after 90 days on satisfactory performance of plant & machinery for two consequent crushing seasons in all respect as per Annexure XVIII and Annexure III after successful trial season and satisfactory performance of co-generaton power plant for two years (atleast 236 days in each year) or 24 months from successful commissioning as per terms of the contract.

4.2 Option of deduction from the bills against Performance Security-II

If the 'Seller' does not provide the performance security-II within one hundred eighty (180) days of signing of the agreement or within such further period as may be advised by the Purchaser, than the amount shall be deducted on prorata basis from each bills.

5.0 CONFIDENTIALITY

The Purchaser and the Seller shall treat the details of the Contract and any information pertaining thereto as strictly confidential and neither of them shall publish or disclose the same or any particulars thereof (save insofar as may be necessary for the purpose of the Contract), without the prior consent of the other provided that nothing in this Clause shall prevent the publication or disclosure of any such information that has come within the public domain otherwise than by breach of this clause or which is required by law.

6.0 NOTICES

6.1 Notices to Purchaser / Seller

Any notice to be given to the 'Purchaser' under the 'Contract' by the Seller shall be served by post or facsimile transmission or email to, or by leaving the same, at the respective addresses notified for that purpose by the Purchaser in the Terms and Conditions as per Clause 6.3 below.

All certificates, notices, decisions, instructions and orders to be given by the 'Purchaser' to the Seller under the Contract shall be served by post or email or facsimile transmission to, or by leaving the same at the Seller's principal place of business or such other address as the Seller shall nominate for that purpose.

6.2 Service of Notices

All notices sent by facsimile transmissions or email shall be deemed to have been served at the time of transmission. A notice sent by post shall be deemed to have been served three (3) days after posting.

6.3 **Addresses for service of Notice**

Any notice or request with reference to the Contract shall be made by letter or fax or email delivered by one party to the other to its representative address given below.

Purchaser's Address : Rajasthan state Ganganagar sugar Mills Ltd., 4th Floor, Nehru Sahkar Bhawan, Bhawani Singh Road, Jaipur – 302006, Rajasthan,e-mail-rsgsmlimited@yahoo.com

Seller's address : _____

_____

7.0 PURCHASER'S OBLIGATIONS

7.1 Assistance with laws & regulations

Purchaser shall assist the Seller to ascertain the nature and extent of any need to comply with laws, regulations, orders or by-laws of any local or national authority having the force of law in the country where the Plant and equipment is to be erected, or which may affect the Seller in the performance of its obligations under the Contract. Purchaser will, if requested, provide copies thereof and the Seller shall reimburse the cost thereof.

7.2 The Purchaser shall make available suitable space for storage of Plant & Machinery and Equipment within the premises of proposed site of sugar factory, free of charge, to the Seller. Secured and covered space shall be provided by the Purchaser for storing items of delicate and sophisticated machinery. The Purchaser may, on the request of Seller, shall also make available suitable area for site fabrication of items provided that the details of essential fabrication works to be done at factory site shall be furnished by the Seller to the Purchaser well in advance.

7.3 To provide motorable approach road from the main road to the site with culverts where required.

7.4 The Purchaser shall make available adequate electric power for site fabrication, at the cost of the Seller.

7.5 The Purchaser shall also make available adequate electric power at site for the Erection at actual cost at one point within three months from the date of signing of the agreement.

7.6 The Purchaser shall provide at its own cost to the Seller adequate water supply at factory site.

7.7 Technical Data or Information if any related with the Purchaser shall be given to the seller in writing.

7.8 The Purchaser shall pay the statutory inspection or other fees and charges payable under any Act or Regulation in respect of the installation, operation or use of machinery and equipment.

7.9 The Purchaser shall obtain from concerned authorities, necessary clearance in respect of water, effluent disposal, layout of factory buildings and any other matter related to this plant and pay necessary fees. For such purpose, the seller shall extend necessary assistance wherever required.

7.10 The Purchaser shall make available in time, agreed upon by both contracting parties, agreed number of Purchaser's personnel to be trained at the Site in accordance with the stipulations in Clause 22.

7.11 The Purchaser shall make available at the Site, in due time agreed upon by both contracting parties, the necessary personnel and materials needed for tests, commissioning, performance test and maintenance to be carried out under the guidance of the Seller's supervisors. The number of the Purchaser's personnel and their qualifications as well as the quantities and quality of the materials necessary for the tests, commissioning and performance test shall be discussed and agreed upon by the respective representatives of both contracting parties as soon as possible.

7.12 Wherever approval of any drawings/technical data of the Seller is required to be given by the Purchaser, the same shall be done within fifteen (15) days of its receipt.

7.13 **Civil work :- (A) IN THE SCOPE OF PURCHASER**- Foundations, necessary buildings including structures,roofing, cladding, trenches, drainage system ,flooring and all related civil work of Plant and Machinery such as mill house, boiler, turbine , boiling house etc. and offices are in the scope of purchaser

(B**) IN THE SCOPE OF SELLER**- Structural work, staging, platforms, railings, approach ladders duly coated with protective paints, lighting for all plant & machinery such as mill house, boiler, turbine, boiling house, ETP etc. are in the scope of seller.

The architect appointed by the purchaser shall prepare detailed designs/ drawings for above mentioned civil work based on load data and foundation drawings provided by the Seller.

7.14 During the operation, competent and sufficient operating personnel shall be provided by the Purchaser at all the time according to agreement between both contracting parties.

7.15 That the operation and maintenance of the equipment/Plant will be done by the Purchaser in accordance with the instructions provided by the Seller and the instructions given by the Seller's supervisors during the course of supervision.

7.16 Required inputs for Plant and Equipments will be supplied by the purchaser as mentioned in Clause 7.17.

7.17 That the Purchaser will supply an uninterrupted quantity of all the essential services which are required for the normal operation of the sugar factory & Co-gen. Power Plant together with adequate quantities of all consumables, process chemicals and chemicals required for maintaining the requisite quality of boiler feed water agreed upon by both contracting parties.

8.0 SELLER'S OBLIGAITONS

8.1 General

The Seller shall, subject to the provisions of the Contract, with due care and diligence, design, manufacture, deliver, erect, test and commission the Plant and equipment within the Time for Commission. The Seller shall also make good of any defects in the Plant and equipment during the Defects Liability Period.

8.1.2 The Seller shall ensure that the requirements of all statutes, regulations and local laws are complied with. No extra costs will be allowed by the Purchaser to the Seller for any additional work done by the Seller to conform to any requirements or procedures contained therein.

8.2 Manner of Execution

The Plant and equipment shall be designed, manufactured and installed & commissioned in the manner set out in the Scope of Work and Technical Specification in as per Clause 1 (e) in the form of Contract **(Annx. VII)** or, where not set out, to the reasonable satisfaction of the Purchaser and all work shall be carried out in accordance with such reasonable directions as the Purchaser may give on Seller's Design.

The Seller shall be responsible for the detailed design of the Plant and equipment in accordance with the requirements of the Specification and performance.

8.3 Packing

8.4.1 The Contract goods will be delivered in transit-worthy packing wherever required corresponding to the requirements for each particular type of goods in transit, transshipment normal handling and storage under climatic conditions in India.

Before packing, appropriate antirust and protective measures for goods, their components and accessories shall be applied, such as grease, coating, oil paper wrapping or polyethylene film wrapping and vacuum packing wherever required

in order to protect the goods from damage, corrosion or deterioration during the transportation and storage.

8.4.2 All packing materials including packing cases, containers, boxes, tins, drums and wrapping, etc. used for supply of Plant and equipment and stores shall be the property of the Purchaser.

8.4.3 The Seller shall supply on the terms and conditions stipulated in the Tender/ Contract the Plant and equipment as specified in Clause 1 (c) of the Form of Contract **(Annx. VII)** to ensure the capacity and guaranteed output of the Plant and equipment items.

8.5 Further the Seller shall make good any defects arising in any Plant and Equipment items or other goods during warranty period, all in accordance with Clause 16 (*Defects Liability)* either by repairing, removing, supplementing or replacing such goods by new ones, as the case may be. Should any shortage of the Plant and equipment items and/or Technical Documentation be found because of omission and/or fault attributable to the Seller, the Seller shall complete it at its own expenses and under the terms of present Contract, as rapidly as possible in order to ensure the execution of the work at the Site in due time.

8.6 The Seller shall under the terms and conditions stipulated in Clause 22 (*Erection, Supervisory Service and Training)* and elsewhere in this Contract, send its technical personnel / supervisors to the Site to carry out supervision of erection / necessary Services and to provide Purchaser's personnel proper instructions methods and/or demonstration for erection, assembly, commissioning, operation, repair and maintenance of the Plant and equipment items to carry out all tests, performance test under this Contract, as well as to train the Purchaser's technical personnel at the Site.

8.7 The Seller shall progressively within eight (8) weeks from the date of LOI furnish Plant and equipment layout and load data and foundation drawings as per the format to suit the erection and commissioning of the Plant and equipment

8.8 The Seller shall supervise the erection and commissioning of the Plant and equipment items and ensure that the same should be erected and commissioned within the period of commissioning as specified in the 'Contract' subject to Clause 31 *(Force Majeure)*.

8.9 Any addition, modification, fabrication, rework at site if required, due to reasons attributable to the Seller, shall be done by the Seller at his cost.

8.10 The Seller, within sixty (60) days of LOI, shall submit to the Purchaser the followings:

i. Detailed Dispatch and Commissioning schedule
ii. Plant and equipment wise price breakups
iii. Any other documents as required by Purchaser

INSURANCES

8.11 Comprehensive Insurance covering “All risk” shall be arranged by the Seller from the time of dispatch and transit of the Plant / Equipment / Machinery to 23‘F’ KAMINPURA Site’ till its commissioning and testing at the site.

8.12 Any damage caused by the supplier’s person / team to purchaser’s property / person will be assessed and recovered from the supplier. In other words, the entire responsibility in connection with any acts or deeds of supplier’s person / team detrimental to purchaser during the course of work will be on supplier’s account.

8.13 At no time will the employees of the Seller or any of its sub-contractors be considered to be employees of the Purchaser. The tenderer and his sub-contractors shall be independent parties who shall maintain and manage their own employees. For such employees all the responsibilities related to injuries/ mishappening shall be of the seller/ Sub-seller themselves. Seller or its sub-contractor shall submit compliance of applicable labour laws and regulation to the purchaser. The Seller shall arrange "**third party insurance"** to those persons working at the site during the contract period.

9.0 PROGRAMME

Within forty five (45) days from the date of LOI, the Seller shall submit to the Purchaser for his approval the Program for the execution of the contract showing.

a) the sequence and timing of the activities by which the Seller proposes to carry out the Contract (including design, manufacture, erection, testing and commissioning).

b) the respective time for submission by the Seller of drawings and operating and maintenance instructions and for the approval thereof by the Purchaser.

c) the time by which the Seller requires the Purchaser to furnish any drawings or information.

9.1 Approval of Program

Approval by the Purchaser of the Program shall not relieve the Seller of any of its obligations under the Contract. The Seller shall submit a PERT chart using a project monitoring software acceptable to the Purchaser

9.2 Alterations to program

The Seller shall not without the Purchaser’s consent make any alteration to the Program

9.3 Revision of Program

If the Purchaser decides that progress under the Contract does not match the Program, he may order the Seller to revise the Program. The Seller shall thereafter revise the Program to show the modifications necessary to ensure commissioning within the Time for commissioning.

9.4 Rate of Progress

The Purchaser shall notify the Seller if the Purchaser decides that the rate of progress of manufacture of any item of the Plant and equipment is too slow to meet the Time for Commissioning and that this is not due to a circumstance for which the Seller is entitled to an extension of time under Clause 13.1. Following receipt of such a notice the Seller shall take such steps as may be necessary and as the Purchaser may approve to remedy or mitigate the likely delay, including revision of the Program. The Seller shall not be entitled to any additional payment for taking such steps.

10.0 DRAWINGS

10.1 The Seller shall submit to the Purchaser for approval:

a) Drawings, Plant and Machinery Layout and information (including calculations) as may be called for therein, and in the numbers therein required:

b) during the progress of the Contract within such reasonable times as the Purchaser may require (8 weeks as mentioned in clause 8.7 of tender) such drawings of the general arrangement and details of the Plant and equipment as may be specified in the Contract or as the Purchaser may reasonably require and the Purchaser shall signify his approval or disapproval thereof. If Purchaser fails to do so within the time given in the Contract or the Program, or, if no time limit is specified, within 30 days of receipt they shall be deemed to have been approved.

Approved drawings shall be signed or otherwise authenticated by the Purchaser.

The Seller shall supply additional copies of approved drawings in the form and numbers stated in the contract.

10.2 Consequences of Disapproval of drawings

Any drawings which the Purchaser disapproves shall be modified and re-submitted without delay.

10.3 Approved Drawings

Approved drawings shall not be departed from except where the Purchaser requests for minor variations.

10.4 Inspection of Drawings

The Purchaser shall have the right at all reasonable times to inspect all drawings of any part of the Plant and equipment.

10.5 Civil Design and Drawing

The Seller shall maintain close liaison with the Purchaser’s Architects for the purpose of civil design and drawings.

The Seller shall provide within the times stated at Clause 8.7 or in the program, drawings, showing how the Plant and equipment is to be affixed and any other information required for:

- preparing suitable foundations or other means of support
- the erection and installation of the Plant and equipment, and
- making necessary connections to the Plant and equipment

10.6 Operation & Maintenance Instructions

Within the time or times stated in the Contract or in the Program and in any event upon Commissioning the Seller shall supply erection, installation, testing, operating and maintenance instructions and drawings of the Plant and equipment as supplied. These shall be in such detail as will enable the Purchaser to operate, erect, install, test, maintain, dismantle, repair reassemble and adjust all parts of the Plant and equipment.

Instructions and drawings shall be supplied in the form and numbers as required by the Purchaser. The Plant and equipment shall not be considered as having been commissioned for the purposes of Clause 15 *(Delay)* until such instructions and drawings have been supplied to the Purchaser.

10.7 Purchaser's use of Drawings etc. supplied by the Seller

Drawings/information supplied by the Seller will be used by the Purchaser only for the purposes of erecting, installing, testing, completing, maintaining, adjusting and repairing the Plant and equipment. No license is granted to the Purchaser to copy or use drawings or information so supplied in order to make or have made spare parts for the Plant and equipment. Drawings or information supplied by the Seller shall not without the Seller's consent be used, copied or communicated to a third party by the Purchaser or the Purchaser otherwise than as strictly necessary for the purposes of the Contract.

10.8 Seller's use of Drawings etc. supplied by Purchaser

Drawings and information supplied by the Purchaser to the Seller for the purposes of the Tender and the Contract shall remain the property of the Purchaser. They shall not without the consent of the Purchaser be used, copied or communicated to a third party by the Seller otherwise than as strictly necessary for the purposes of the Contract.

10.9 Manufacturing Drawings etc.

Notwithstanding any other provisions of the Contract the Seller shall not be required to provide to the Purchaser shop drawings or any Seller's confidential manufacturing drawings, designs, or know-how or the confidential details of manufacturing practices, processes or operations.

10.10 Errors in Drawings etc supplied by Seller

Notwithstanding approval by the Purchaser of drawings or information submitted by the Seller, the Seller shall be responsible for any errors, omissions or discrepancies therein unless they are due to incorrect drawings or information supplied by the Purchaser or the Purchaser representative.

The Seller shall bear any cost it may incur as a result of delay in providing such drawings or information or as a result of errors, omissions or discrepancies therein, for which the Seller is responsible.

The Seller shall at its own expense carry out, or bear the reasonable cost of, any alterations or remedial work necessitated by such errors, omissions or discrepancies for which he is responsible and modify the drawings or information accordingly.

The performance of Seller's obligations under this clause shall be in full satisfaction of the Seller's liability under this clause but shall not relieve it of liability under Clause 15 (*Delay*).

10.11 AS BUILT DRAWING

Seller shall submit five sets of "AS BUILT DRAWING" to the Purchaser immediately after successful commissioning of Plant and Equipment.

11.0 INSPECTION AND TESTING OF PLANT AND EQUIPMENT BEFORE DISPATCH

11.1 Purchaser's Entitlement to test etc.

The Purchaser shall be entitled at all reasonable times during manufacture to pre-dispatch inspection, examine and test on the Seller's premises the materials and workmanship and performance of all Plant and equipment to be supplied under the Contract. If part of the Plant and equipment is being manufactured on other premises, the Seller shall obtain from the Purchaser, permission to inspect, examine and to test as if the Plant and equipment were being manufactured on the Seller's premises. Such inspection, examination or testing shall not release/absolve the Seller from any obligation under the contract.

11.2 Date for Tests or Inspection

The Seller shall inform the Purchaser reasonably in advance the date and the place at which any Plant and equipment will be ready for the tests or pre dispatched inspection as provided in the Contract. The Purchaser shall give the Seller 72 hours' notice of his intention to attend the Tests or inspection. If the Purchaser shall, barring reasons attributable to Force Majeure, not attend at the place so named on the date agreed, the Seller may proceed with the tests or inspection, which shall be deemed to have been made in to the Purchaser's presence. The Seller shall forthwith forward to the Purchaser duly certified copies of the results of the Tests or inspection. Such inspection shall be carried out by the Purchaser team and its experts.

11.3 Services for test or inspection

The Seller shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out the Tests or inspection.

11.4 Certificate of tests or inspection

When the Purchaser is satisfied that any Plant and equipment has passed the Tests or inspection referred to in this Clause he shall forthwith issue to the Seller a certificate to that effect

11.5 Failure on tests or inspection

After inspecting, examining or testing any Plant and equipment the Purchaser shall if decide that such Plant and equipment or any part thereof is defective or not in accordance with the Contract, he may reject the said Plant and equipment or part thereof by giving the Seller, notice of such rejection within seven (7) days, stating therein the grounds upon which the said decision is based.

Following any such rejection the Seller shall make good or otherwise repair or replace the rejected Plant and equipment and resubmit the same for the Tests or inspection in accordance with this Clause and all expenses reasonably incurred by the Purchaser in attending or in consequence of such re-testing or inspection shall be deducted from the Contract Price.

11.6 The design and manufacture of the Plant and equipment items shall confirm to Indian standards.

11.7 The testing and inspection will be according to applicable Indian standard and good Purchasing practice. In case there is no applicable Indian standard, the test and inspection shall be carried out to ensure that the equipment is manufactured according to the design and manufacturing requirements of respective Plant and equipment items. The results of testing and inspection shall be drawn up in test report(s) and certificate(s) of quality shall be issued indicating the important and essential details of the testing which are in conformity with the above-mentioned standards.

11.8 The Purchaser has the right to send its representative(s) at Purchaser's expense to the Purchasing offices and workshop or factory of the Seller and/or of the Seller's sub-supplier(s) at all times, within normal working hours after giving due notice, for the purpose of checking relating to the accomplishment of the Seller's contractual obligations, the workmanship and the quality of the Plant and equipment items, wherever in progress, as well as the quality of materials used in manufacturing of the Plant and equipment items concerned, provided the work is not interrupted as a result.

11.9 The Seller shall make available to the Purchaser's representative(s), free of charge, such conditions and means necessary at the Purchasing offices and workshop for the testing and inspection of the Plant and equipment items concerned and for design work. The Seller shall within 90 (ninety) days from the

Effective Date of the Contract send to the Purchaser a list of Plant and equipment items to be tested and inspected.

11.10 The Purchaser reserves the right to ask the Seller to arrange tests and inspections for the Plant and equipment items which the Purchaser wishes to inspect for which he shall provide the list within 15 days of receiving the list in Clause 11.9 above.

11.11 The Seller shall notify the Purchaser by fax / email at least one week before the scheduled dates of the tests and inspections of Plant and equipment items to enabling the Purchaser to enable travel for its representatives.

11.12 At least 3 (three) days before the dates scheduled by the Seller, the Purchaser shall notify the Seller of its representative(s) who will participate in the testing and inspection and at the expiry of which period, barring force majeure, the Seller shall be free to Dispatch the items for delivery to the Purchaser.

11.13 The attendance or participation of the Purchaser's representative at the tests and inspections carried out by the Seller and Seller's sub-supplier(s), or the above mentioned representative's agreement to the results of the tests inspections shall not be deemed as releasing the Seller from any undertaking with regard to the quality and quantity of the Plant and equipment items and does not in any way limit the Purchaser's right with regard to the guarantees mentioned in Clause 17 (*Warranty and Performance Guarantee)*.

11.14 If the Purchaser's representative(s) find that the Plant and equipment items do not conform to the standards agreed by both contracting parties and/or to the conditions of the present Contract, then the Seller undertakes to eliminate immediately these defaults by his own means and expense without detriment as far as possible to the commissioning period of said Plant and equipment items. After elimination of the said manufacturing defaults, the Plant and equipment items in question shall be submitted to new tests under the conditions specified in this article.

11.15 The Seller shall not sell or divert any material, sub-assemblies, machinery and equipment meant for the sugar plant & Co-gen. plant of the purchasers, after the same have been inspected by the purchasers, or an authorized representative of the purchasers, under any circumstances, without prior written consent of the purchasers as per terms of this agreement.

12.0 DISPATCH

12.1 Dispatch

The Seller shall inform the Purchaser in writing with respect to the date and intended Dispatch of plant and equipment for permission to Dispatch. No item shall be dispatched without the Purchaser's written permission.

The Seller will obtain permission from the Purchaser for dispatching the items out of the agreed schedule of dispatches.

On receipt of the Seller's request the Purchaser shall grant permission within 72 hours failing which the Seller shall have the right to Dispatch.

12.2 Dispatch terms

Save as varied by the Conditions, the obligations of the parties in relation to the Dispatch term specified in the Contract and the rules determining the passing of the risk of loss or damage to the Plant and equipment shall be fixed in accordance with the most recently published edition of the International Rules for the Interpretation of Trade Terms (INCOTERMS) of the International Chamber of Commerce at the date of the Contract.

12.3 Defects before Dispatch

Without prejudice to the Purchaser's rights under Sub-Clause 11.5 (*Failure on Tests or Inspection*), if in respect of any part of the Plant and equipment not yet Dispatched, the Purchaser shall at any time:

a) decide that any work done or materials used by the Seller or by a Sub-Seller is or are defective or not in accordance with the Contract, or that such part is defective or does not fulfill the requirements of the contract (all such matters being hereinafter in this Clause called `defects); and

b) as soon as reasonably practicable notify the Seller of the said decision, specifying particulars of the defects alleged and of where the same are alleged to exist or to have occurred then the Seller shall with all speed and at his own expense, make good the defects so specified. Nothing contained in this Clause shall affect any claim by the Purchaser under Clause 15 *(Delay)*.

13.0 Time for Commissioning

The Seller shall so execute the contract that the Plant and equipment shall be commissioned within the stipulated period mentioned in PERT / BAR CHART from the date of agreement.

13.1 Extension of Time of Commissioning

If by reason of any act or omission on the part of the Purchaser of any of the industrial dispute or by reason of circumstances beyond the reasonable control of the Seller arising after the acceptance of the tender, the Seller shall have been delayed in the commissioning of the Plant and equipment, whether such delay occurs before or after the time of Dispatch, then provided that the Seller shall as soon as reasonably practicable have given to the Purchaser or the Purchaser notice of his claim for an extension of time with full supporting details, the Purchaser shall on receipt of such notice grant the Seller from time to time in writing either prospectively or retrospectively such extension of the Time for commissioning as may be reasonable.

13.2 If the seller fails to receive payment of any installment(s), of any advance or for supply on account of non-compliance of any contractual obligation on his part,

the seller shall not be entitled to any extension or time for delivery and commissioning.

14.0 CONDITIONS AND TIME OF DISPATCH

The Seller shall dispatch the Plant and equipment items and the Technical Documentation all in accordance with the commissioning schedules

15.0 DELAY

15.1 Delay in Delivery of Plant and Machinery and its commissioning

If the Seller fails to supply and commission the Plant and equipment or any item within the scheduled time of delivery or Commissioning, or if no Time for Commissioning is specified, within a reasonable time, there shall be penalties deducted from the Contract Price and paid to the Purchaser by the Seller, at the rate stated in the Clause 20 (*Liquidated Damages)* of the Contract Value of such parts of the Plant and equipment as can not be, in consequence of the said failure, put to the intended use, for each fortnight or part thereof of delay between the Time of delivery and commissioning and the actual date of delivery and commissioning. However the amount so deducted or paid shall not exceed the maximum percentage stated in Clause 20 (Liquidated Damages) of the Contract Value of such parts of the Plant and equipment, and such deduction or payment shall subject to Clause 15.2 (*Prolonged Delay*), be in full satisfaction of the Seller's liability for the said failure.

15.2 Prolonged Delay

If any part of the Plant and equipment in respect of which the Purchaser has become entitled to the maximum amount provided under Sub-Clause 15.1 (*Delay in Commissioning*) is not commissioned, the Purchaser may by notice to the Seller require to commission the same within such time (not being less than 21 days) as the Purchaser may specify in the notice. If the Seller fails to commission such Plant and equipment within the time so specified the Purchaser shall be entitled, after having given the Seller notice of his intention to do so, to purchase such incomplete Plant and equipment in place of the un-commissioned Plant and equipment and the value shall be deducted from the Contract Price that part thereof which is properly apportionable to the un-commissioned Plant and equipment. The Seller shall pay to the Purchaser any sums by which the expenditure reasonably incurred by the Purchaser in obtaining such Plant and equipment in place of the un-commissioned Plant and equipment exceeds the sum deducted. All such Plant and equipment obtained by the Purchaser in place of un-commissioned Plant and equipment, shall be obtained at reasonable prices under the then prevailing circumstances.

16.0 DEFECTS LIABILITY

16.1 Defects after Commissioning

In these Conditions the expression `Defects Liability Period' means the period stated in the Clause 17.1 (*Warranty and Performance Guarantee*) and deemed to have commenced from the date of commissioning of Plant and Equipment.

16.2 Remedies to defects

The Seller shall be responsible for making good by repair or replacement with all possible speed at his expense including freight costs to the Purchaser site any defects in or damage to any part of the Plant and equipment which may appear or occur during the Defects Liability Period and which arises either:

a) from any defective materials, workmanship or design, or

b) from any act or omission of the Seller done or omitted during the said period.

If any such defect shall appear or damage occurs the Purchaser shall forthwith inform the Seller thereof stating in writing the nature of the defect or damage. The provisions of this clause shall apply to all repairs or replacements carried out by the Seller to remedy defects and damages except that the period during which the Seller's responsibility as mentioned herein shall subsist either for 12 months from the date of replacement or renewal or repair of the damage or the unexpired period of the Defects Liability Period, whichever is the later.

The supply to the Purchaser, insured and carriage paid, to the address stipulated by the Purchaser of a replacement for a defective or damaged part or Plant and equipment item shall constitute fulfillment by the Seller of its obligations under this sub-clause in respect of that defective or damaged part or item. If it is reasonably practicable for a defective or damaged part or item to be returned to the Seller and the Seller shall call for its return the Purchaser shall cause it to be returned to the Seller at the Seller's risk and expenses.

16.3 Notice of defects

If any such defect shall appear or damage occur the Purchaser shall forthwith inform the Seller thereof stating in writing the nature of the defect or damage. The provisions of this clause shall apply to all repairs or replacements carried out by the Seller to remedy defects and damage except that the period during which the Seller's responsibility under sub-clause 16.2 *(Remedies to defects)* shall subsist shall be either 12 months from the date of replacement or renewal or repair of the damage or the unexpired period of the Defects Liability Period whichever is the later to expire.

16.4 Extension of defects liability

If any part of the Plant and equipment cannot be put to its intended use by reason of defects in or damage to any other Plant and equipment the Defects Liability Period in relation thereto shall be extended by a period equal to the period during which such part of the Plant and equipment cannot be used.

16.5 Delay in remedying defects

If any such defect or damage be not rectified within a reasonable time, the Purchaser may proceed to do the work at the Seller's risk and expense provided that it does so in a reasonable manner and notifies the Seller of its intention so to do. The costs reasonably incurred by the Purchaser shall be deducted from the Contract Price or be paid by the Seller to the Purchaser.

16.6 Further tests

If the repairs or replacements are of such a character as may affect the operation of the Plant and equipment or any part thereof, the Purchaser may notify the Seller that the Purchaser will repeat such tests thereof as were carried out prior to Dispatch. The costs reasonably incurred by the Purchaser in such tests so notified shall be deducted from the Contract Price. The Seller may attend such tests on reasonable notice to the Purchaser.

16.7 Limitation of liability for defects

The Seller's liability under this Clause shall be in lieu of any condition or warranty implied by law (or where such condition or warranty cannot be excluded in supplementation thereof) as to the quality or fitness for any particular purpose or the workmanship of any part of the Plant and equipment delivered. Save as in this Clause and in Sub-Clause 16.8 (*Latent Defects*) expressed, neither the Seller nor its Sub-Sellers, their respective servants or agents, shall be liable, whether in contract, in tort (including but not limited to negligence) or by reason of breach of statutory duty or otherwise, in respect of defects in or damage to such part, or for any damage or loss of whatsoever kind attributable to such defects or damage or any work done or service or advice rendered in connection therewith.

16.8 Latent Defects

If any defect of the kind referred to in Sub-Clause 16.2 (Remedies to Defects) shall appear in any part of the Plant and equipment within a period of three years after the date of Dispatch of such part of the Plant and equipment, the same shall be made good by the Seller by repair or replacement, provided that the defect was caused by the gross misconduct of the Seller as defined below and would not have been disclosed by a reasonable examination prior to the expiry of the Defects Liability Period.

'Gross Misconduct' does not comprise each and every lack of care or skill but means an act or omission on the part of the Seller which implies either a failure to pay due regard to the serious consequences which a conscientious and responsible Seller would normally foresee as likely to ensure or a willful disregard of any consequences of such act or omission.

17.0 WARRANTY AND PERFORMANCE GUARANTEE

17.1 Warranty

17.1.1 The Seller guarantee that all materials used in construction of the Plant and equipment items will be brand new, of good quality and suitable for the purpose for which the materials are applied, and that the workmanship will be of good quality and as per the specifications/ standards provided herein.

17.1.2(A) The Warranty period of Plant and equipment/items supplied and commissioned (except bought out items) under this contract, will be up to thirty (30) days after completion on satisfactory performance of plant & machinery for

two consequent crushing seasons in all respect as per Annexure XVIII and Annexure III after successful trial season and satisfactory performance of co-generaton power plant for two years (atleast 236 days in each year) or 24 months from successful commissioning as per terms of the contract.

(B) Performance of bought out items: Bought out component guarantee will be passed on to purchaser as per guarantees given by manufacturers which should be 18 months from date of supply or 12 months from erection which ever is earlier.

17.1.3 Immediately after a defect(s) is/are discovered, but not later than thirty (30) days thereafter, the Purchaser shall inform the Seller by written communication /fax/email and request the Seller to eliminate the defect(s). The Seller shall take urgently the necessary measures to eliminate the faults as soon as possible after receiving the Purchaser's communication stating details about the fault(s).

17.1.4 The Seller will be responsible to repair or replace any defective or damaged part at its own expense during the Warranty Period. In case of any delay in such repair or replacement attributable to the Seller's fault the Warranty Period shall be extended accordingly.

17.1.5 In the event of replacement or repair, the duration of the Warranty Period for the replaced item and/or section as the case may be, is automatically extended only by a period equal to the period during which the item and/or section is out of operation as a result of the replacement or repair caused by the defective part(s).

17.1.6 Any defective parts replaced by the Seller shall be the Seller's property and shall be returned to the Seller upon its request at the Seller's expense.

17.2 Performance

The Seller guarantees the performance for the entire Plant and equipment supplied by him and the values provided therein shall be binding on him. The terms under Performance Guarantees provided by the Seller under this Contract, is as below:

17.2.1 The guaranteed performance Parameters to be achieved by the Seller are given in **Annexure - III** along with the required inputs to be provided by the Purchaser to achieve the said performances:

All the Plant and equipment and equipment/supplies items are those in which the shortfall in performance is not acceptable.

For these items above, the Supplier shall carry out modifications to obtain the guaranteed performance. These must be corrected even before trial run is started. And further, these parameters must remain stable throughout the period of trial run. All work related to correction and subsequent trial run to prove stability/reliability shall be completed within the guaranteed period with no extra cost to the Purchaser.

The release of Performance guarantee shall be subject to 100% achievement of performance parameters as given in **Annexure-III**. Partial release of

performance guarantee against achievement of part performance will not be allowed.

If finally, despite all effort on the part of the Seller, the stipulated guarantees on these parameters are not established, the Purchaser retains the option to reject the equipment. In case the option to reject is exercised by the Purchaser, the Seller shall replace the rejected equipment within a reasonable period of time as will be indicated by the Purchaser, and achieve the performance as guaranteed in the tender.

Purchaser shall have the option to replace the defective/non-performing (as per performance parameter of **Annexure-III**) machinery/equipment at the risk and cost of the Seller.

In the event of plant and equipment rejection for reasons as covered above, it is obvious that the overall project schedule will be affected. To minimize the loss due to such an occurrence, the Purchaser retains the right to use as best as possible, the defective equipment until new replacement arrives at site for erection. During this period the Seller shall not limit the use of the defective equipment, except for reasons of safety during operation, both of personnel and the equipment. Performance guarantee-BG III (5% of total contract price including taxes,duties as quoted) will be released after 90 days on satisfactory performance of plant & machinery for two consequent crushing seasons in all respect as per Annexure XVIII and Annexure III after successful trial season and satisfactory performance of co-generaton power plant for two years (atleast 236 days in each year) or 24 months from successful commissioning as per terms of the contract.

1. The said performance guarantee deposit shall not in any way be constructed as limitation of the conractors responsibilities or liability pertaining to its obligation and/or guarantees under the contract and shall be without prejudice and in addition to any other remedies available to the RSGSML in terms of the contract and /or the laws of the land.
2. RSGSM shall be at liberty to realize and enforce payment of the performance guarantee for or on account of any non-fulfillment and unsatisfactory performance of the contract without any notice or reference to the contractor and shall be binding on the contractor.
3. The bank guarantee shall remain binding and irrevocable notwithstanding such variations, alterations or extensions of completion time as may be made, given conceded, agreed to between the contractor and the rsgsml under the general conditions otherwise.

18.0 VESTING OF EQUIPMENT / PLANT AND MACHINERY

18.1 The Plant and equipment, whether installed or not, shall immediately, in consideration of the first installment of the Contract Price to the Seller by the Purchaser, becomes and remains the property of the Purchaser, provided always that the Seller shall have a particular possessory lien on the Plant and equipment and equipments to the extent the value thereof exceeds the total value of the payments made by the Purchaser to the Seller.

18.2 Notwithstanding the provisions of Clause 18.1 above, the Seller shall be responsible for all damages too and loss of all aforesaid Plant and equipment and equipments supplied by the Seller, until the plant and equipment has been successfully commissioned.

18.3 Plant and equipment to be supplied pursuant to the Contract shall become the property of the Purchaser when the Plant and equipment is commissioned.

18.4 Purchaser's rights, risk and cost clause.

If the successful tenderer fails to execute the work as per order / schedule purchaser reserves the right to procure the same from alternate sources at supplier's risk and cost.

19.0 TERMS OF PAYMENT

19.1 For Supply, Erection, Commissioning and successful performance and to provide for one year technical supervision staff.

19.2 Supplier shall raise the bill as per price break –up and priority of supply for design, manufacturer, supply of plant and machinery (including services) and supervision, erection , commissioning and performance and accordingly payment will be made through Cheque/RTGS in favour of Seller in the following manner:-

19.2.1 First Advance :- Five percent (5%) of the Contract Price (CP) (including taxes, duties etc as quoted) against entire scope of supply of plant & macnhinery as per Annexure-I as mobilization Advance which will be paid after issuance of the work order and within 15 days on furnishing of a Bank Guarantee (BG-I) of equal amount in the format detailed at Annexure-IV. The validity of BG-I shall be 15 months.

19.2.2 Second Advance :-Five percent (5%) of the Contract Price (CP) (including taxes, duties etc as quoted) against entire scope of supply of plant & macnhinery after submission of Bank Guarantee II of equal amount as per Annexure V with a validity of 15 months and on submission of following documents to the Purchaser confirming that the Contractor has fulfilled the conditions mentioned below :-

a. Placing order and providing the order acceptance by the respective out source suppliers of the following long delivery items:-

i. Complete Boiler plant including / mountings & auxiliaries.
ii. Turbo-alternator set.
iii. Planetary gear boxes & Rope coupling for mills.
iv. Clarifier & Vacuum filter.
v. Mill & fibrizer drives i.e. electric motors.(AC VVVFD & Panels for mills)
vi. H.T. panels and H.T. transformers.
vii. DG sets of 500 KW & 100 KW.
viii. Mill & fiberizer

The proof of order acceptance by the parties for supplying long delivery items should indicate clearly the items of order placed on them with major technical specifications, agreed date of delivery and should also confirm that the said items are for RSGSML, Sriganganagar

b. Submission of following documents

i. P & ID for Boiler.

ii. Steam, power and water balances for sugar plant.

iii. Month-wise funds requirement to be supported by actual value of shipment.

iv. Detailed Dispatch and Commissioning schedule including PERT/CPM.

v. Plant and equipment wise price breakup

vi. Plant lay out and civil foundation & structural designs, GA drawings

vii. List of detailed specifications of bought out items.

viii. Any other documents as required by Purchaser.

c. Complying all other contractual obligations which have become due upto that time.

d. The seller shall produce a utilization certificate of the second advance, within 30 days of receiving it. They shall also furnish the proof and confirmation by the sub suppliers of seller in respect of bought out items.

19.2.3 The advance amount given 10% as above against bank guarantees referred in point nos. 19.2.1 & 19.2.2 shall be deducted from the supply bills and then automatically adjusted and get reduced by the equivalent amount with the progress of delivery of materials to the extent of total value of Machinery & Equipments related items dispatched by the seller upto that time.

Provided further that if the contract is terminated due to default of Seller, the mobilization advances First and Second as mentioned in Clause 19.2.1 & 19.2.2 would be deemed as interest bearing advance at interest rate of 12%, to be compounded quarterly.

19.2.4 Performance Security-I: Performance Security-I will be 5% of contract price, including taxes, duties etc as quoted (in addition to BG-III). After award of the contract Bid Security already deposited by the Supplier shall be converted into Performance Security-I and balance amount (about 3% to make Performanc Security-I 5%) shall have to be deposited by the successful tenderer within 15 days from the issuance of LOI, by way of DD/ Bank Guarantee (valid for 3 years) from a scheduled bank.

19.2.5 Performance Security-II: Supplier will give bank guarantee (BG-III) from a scheduled bank equivalent to 5% of contract price, including taxes, duties etc as quoted in the format detailed at Annexure VI within 180 days from the date of signing of Agreement against Performance guarantee as per clause 17.2.1 and faithful execution of the contract and fulfillment of the obligation in totality. The validity of BG III shall be 3 years. However, if supplier does not provide bank guarantee then 5% deduction on prorata basis will be made from each bills.

19.2.6 From the supply bill, the following deduction shall be made :-

i. 10% towards advance amount given.

ii. 5% deduction on prorata basis towards performance security-II (BG-III). (If the seller fails to submit B.G.-III)

iii. Statutory deductions such as income tax, sales tax, service tax or any other duty, cess or levy as applicable.

iv. 3% deduction shall be made from each bills as retention money against security ,which will be released after 24 month from successful commissioning .

19.2.7 If Bank Guarantees as mentioned in Clause 19.2.6 (ii) are not submitted in due time then, approximatly Eigthy Two (82%) of bill/ invoice raised, after adjusting the 10% (5% + 5%) advance, 5% performance Security-II,3% retention money and hundred percent (100%) of excise duty and CST/VAT actually paid by the Seller (other than taxes to be deposited directly by the procurer) shall be paid as per stage wise progress of work of supply as per Price break up of plant & machinery in the format available at Annexure VIII. If Bank Guarantee for Performance Security-II is submitted in due time then the deductions related to this guarantee shall not be made i.e. in such case approximate 87% of bill/ invoice raised shall be paid within fifteen(15) working days from receipt of bill complete in all respect and after submission of the following documents by the seller :-

i.	Invoices in original	2 sets
ii.	Packing list in original	2 sets
iii.	Permission to dispatch & Proof of dispatch	2 sets
iv.	Inspection certificate/s NFCSF	2 sets
v.	Proof of payment of Excise Duty in original	2 sets
vi.	Proof of payment of CST in original	2 sets
vii.	Transit Insurance Documents	2 sets
viii.	Certificate of satisfactory delivery at site and statement for deduction/ or non deduction (if any) as the case may be issued by authorized representative of RSGSM	2 sets

The Seller shall submit the break up price to purchaser for stage wise completion of supply erection & commissioning work, hydraulic trials, installation of all instrumentation control loops and PLC / DCS System and to start successful commercial production as per performance parameters given in the Annexure III and adhering to schedule given in PERT chart. Accordingly, payment of bills will be made as per work progress.

It is to be expressely understood that the drawl of payment by the contractor/seller, in the manner specified, shall not be constructed as the fulfillment of the contractors obligation, either in part or while under the contract and that the contract shall continue to remain responsible to RSGSML until all the obligation under the agreement are satisfactorily discharged and faithfully fulfilled.

19.2.8 That the bills and dispatch documents should accompany the inspection report (in case where inspection is required as provided in this bid) or inspection waiver certificate from the purchaser/ Purchaser's Inspecting Agency for equipment or material inspected before dispatch.

If requested by the successful tenderer payment through Letter of Credit (L.C.) can also be considered. In such a case payment shall be made after delivery of machinery at site as under :-

19.2.9 If an arrangement of payment through letter of credit(L.C.) is considered by the purchaser then a revolving fund of 200 lac. Will be placed with the purchaser's banker authorized to operate the L.C. on behalf of purchaser.

19.2.10 The letter of credit (L.C.) shall be operable against the bills, other dispatch documents, inspection report (where provided in the bid) and only upon satisfactory delivery of plant/ equiqments/ material at proposed site. Before any payment against the letter of credit is made, the purchaser's bank shall scrutinize the bills and other dispatched documents in accordance with the relevant terms and conditions of L.C. and confirmation of delivery of goods by the purchaser.

19.2.11 **Invoice/VAT Invoice :**

To be issued by the seller , in the format as required by law (service tax law/sales tax law) indicating clearly the product , quantity ,agreed prices and separately stating the service tax,sales tax(CST/RVAT) in the Invoice itself.

19.2.12 Dispatch lists.

(i) Photostat copies of Road Transport receipts (R/R) from transporter with endorsement thereof, if any, evidencing dispatch of goods. (destination site of the purchaser's factory).

(ii) That every invoice contains a reference of the items number according to base price breakup by Seller against each item of plant and machinery supplied.

(iii) Unless the Seller has submitted to the bank photostat copy of the guarantees furnished, the bank shall deduct 5% (performance security) of the gross amount of the bill. Such deduction shall be made only for the bank guarantees which have not been actually submitted by the seller.

19.2.13 EXPLANATION

While raising the bills upon satisfactory delivery at factory site of any part of the consignment of the plant and machinery, the Seller shall always deduct there from proportionate advance given by that time to the Seller. Each bill presented for drawl of payment will clearly show the total price of the items mentioned in the bill & amount of proportionate deduction for payment already received by the seller against the advance payment and the net amount payable.

19.3 Taxes & duties

19.3.1 The government taxes, duties,cess or levies, as applicable, whether under Central or State laws" for work contract /turnkey projects shall be the absolute

liability of the tenderer and shall form part of total contract price. No additional claim shall be raised for the same.)

19.3.2 The tenderer must declare /state the taxes, levies, duties and cess clearly in the Invoice/VAT invoice. if these are to be deposited by the purchaser ,under the relevant law e.g. sales tax, service tax under the reverse charge mechanism ,as applicable, then the purchaser shall deduct and deposit the same with the statutory authority and give a challan to seller for the same .otherwise ,if the tenderer /seller is required to deposit the same ,then the purchaser shall reimburse only after the documentary proof of having deposited the same by the tenderer /seller is submitted to the purchaser. However, in no case the contract price will exceed than the specified agreed value except in case of increase in the relevant rate of taxes.

19.3.3 Octori / Entry tax shall be the liability of the tenderer and shall form part of the total contract price.

19.3.4 Sales tax / VAT

Under the current RVAT Act, the Purchaser has been made liable, in certain situations, to deduct the sales tax at source and deposit the same with the Rajasthan Sales tax department. This is in addition to the Work Contract Tax deductions as defined in the RVAT Act. Thus the same shall be complied with accordingly by the Purchaser. However, if the tenderer is found deficient in compliance of true calculation or payment of Sales tax, appropriate deductions shall be made from the pending payments in any form or from future payments as shall fall due for payment.

The purchaser shall arrange for "C" form, if so required, to the extent as permitted under the CST/RVAT act. However, it shall be the liability of the seller to arrange on its own the road permits(VAT47) for bringing the goods in to the rajasthan state.

19.3.4(a) **Service tax**:-

It shall be the sole responsibility of the Contractor/tenderer to ascertain true and correct liability under the service tax laws and the contractor /tenderer shall not have any fall back option for any mistake in the ascertainment of the same either at the stage of bidding or there after . If the reverse charge mechanism under the service tax law is applicable, now or in future, then the same shall become operative accordingly.

19.3.5 Excise Duty :

The rates quoted should be F.O.R. destination at Integrated Sugar Mills site including all Taxes. Any increase in rates of Excise duty or any other Tax imposed by Central Govt. or State Govt. after the due date of the submission of Tender will be paid extra. Similarly any reduction in the Excise duty and any other Tax after the due date of Tender will be paid less to the Party. In case of delay in supply, increase in excise duty/ any other taxes shall be borne by the tenderer

The supplier shall furnish to the Rajasthan State Ganganagar Sugar Mills Ltd., with their bill, excise duty, gate pass in the support of duty and special excise duty, if any, paid both for the basic price to avail Excise CENVAT credit. If excise

invoice is not submitted the relative excise duty amount will be liable for deduction from bill as per excise rules.

19.3.6 Income Tax :

Income Tax, as applicable, will be deducted at source, while releasing the payment against R.A. – Bill / Total Bill.

19.3.7 Change in Tax Structure :

Any increase or decrease in rates of taxes or duties will be made applicable to both the purchaser & supplier subject to the authenticated enactment / notification. The increase/decrease shall be restricted only to those taxes which have formed part of the bid price/contract, as given by the tenderer at the bidding stage. The Purchaser shall not be burdened for any taxes, duty, cess or levy which has not been elaborated in the bid price unless it is an altogether new tax/duty/cess or levy through a statutory enactment.

The increase in the amount of taxes and duties will be on supplier's account if the material is not supplied as per delivery / dispatch schedule / PERT chart.

Amount of various taxes to be calculated and filled in the price bid by the bidder very carefully. Both the amount and rates of taxes shall have to be mentioned in the price bid . Amount of tax as mentioned in the price bid shall be the basis for calculation of increase /decrease in taxes on account of changes in the rates of tax only. Basic amount of tax mentioned in the price bid shall not be allowed to be revised for any failure /error in calculation. Only variation in rates of taxes will be made applicable to both the parties.

19.3.8 Any duty and taxes etc. paid at the time of purchase shall be refunded to the purchaser in the event of same being held to be not payable. The purchaser shall have the right to appropriate/adjust such duties /taxes which were not validly or legally payable.

20.0 LIQUIDATED DAMAGES

20.1 For Delay

20.1.1 If the seller fails to execute the order / contract within the specified period arising from, any unforeseen reasons, such as strike, fire, accident, act of GOD resulting in stoppage of work the manufacturer or similar reasons which the Director In Charge may find valid for extension of time he may extend the period without charging any agreed liquidated damages. His decision shall be final regarding the sufficiency or otherwise of ground for extension of time.

20.1.2 If the seller fails to carryout the activities (as mentioned in tender/contract/ PERT chart) related to execution of the contract within the period specified, the Director in charge may at his discretion allow extension of time, with recovery from the tenderer the liquidated damages and not by way of penalty, a sum equal to the following percentage of the value of goods/ services which the tenderer has failed to supply for the period of delay as stated below :

a) Delay up to one fourth period of the prescribed contract period – 2.5%.

b) Delay exceeding one fourth but not exceeding half of prescribed contract period – 5%.

c) Delay exceeding half but not exceeding three fourth of the prescribed contract period – 7.5%.

d) Delay exceeding three fourth but not exceeding the period equal to the prescribed contract period – 10%.

20.1.3 Calculation of LD: If supplies are taken at more than one place then total supplies received at various places during the period of supply schedule shall be considered for calculating liquidated damages.

NOTES :

(a) Fraction of a day in reckoning the period of delay in supplies shall be eliminated if it is less then half a day.

(b) The maximum amount of Liquidated Damages shall be 10%.

(c) When the successful Tenderer is unable to complete the order/contract within the specified or extended period, the Purchaser shall be entitled to accept supply/ get work done from the open market without notice to the tenderer, but at his risk and cost i.e. tenderer's account and risk. The goods or any part thereof which the tenderer has failed to supply, if not available, the best and nearest available substitute thereof can be ordered or the purchaser may cancel the contract and the tenderer shall be liable for any loss or damage which the purchaser sustained by reason of such failure on the part of the tenderer. But the tenderer shall not be entitled to any gain on such purchase made against default. The recovery of damage, if any, shall be made from any sum accruing to the tenderer under this or any other contract with the purchaser. If recovery is not possible from the bills and the contractor fails to pay the loss or damage within one month, the recovery shall be made under any law for the time being in force or from any other bills outstanding with the Purchaser.

21.0 BANK GUARANTEES

21.1 The Seller shall provide the Bank Guarantees for due performance of the Contract and the guaranteed performance of the plant and equipment supplied and commissioned by the Seller in the manner stated in Clause 4.1

21.2 In the event of delays accepted by the Purchaser beyond the validity period of the Bank Guarantee and where extension of Contract period is granted by the Purchaser, the Seller shall obtain and provide suitable extensions of the Bank Guarantees as advised in writing by the Purchaser or obtain fresh Bank Guarantees.

21.3 The Seller shall submit extension of Bank guarantees as and when they become due for renewal/extension 15 days prior to the renewal date or expiry date.

21.4 All bank charges and all other charges in connection with bank guarantees shall be borne by the contractor.

21.5 All BG's shall be in favour of RSGSML and issued from Scheduled Bank.

22 .0 ERECTION, COMMISSIONING SUPERVISORY SERVICES AND TRAINING

22.1 The Seller shall depute at Purchaser's site the technical personnel to carry out the erection & commissioning, supervisory services and training.

General detail of the Seller's team including Site Manager to be deputed at site shall be submitted by the Seller within 2 months of the effective date of the Contract.

22.2 The Seller's site Manager being the Seller's chief representative at site, will coordinate all site activities including discussions and on the spot decisions where required, with the Purchaser

22.3 The Purchaser and the Seller's representatives will recommend necessary modifications required, if any, in respect of various activities including erection and commissioning schedule for approval of the Director Incharge/ General Manager, RSGSM. This is to ensure prompt actions which are required for timely Commissioning of Plant and equipment. They shall meet and discuss regularly on all aspects related to the Commissioning of Plant and Equipments.

22.4 The Site Manager deputed by the Seller shall undertake to provide the Purchaser's technical personnel with the following technical supervision and assistance under this contract:

a) To provide proper, complete, correct, logical, systematic and adequate technical instructions and advice for the successful Commissioning and efficient performance of the plant and equipment.

b) In order to conduct performance tests and have them accepted by the Purchaser, the Seller's supervisors will train the Purchaser's personnel on erection & commissioning, testing, operation, usage, repair and maintenance of the plant and equipments, in accordance with the training program provided to the Purchaser by the Seller.

c) Apart from three sets of operations (Users) manuals and Maintenance Manuals, the Seller must provide three sets of Parts Listing (Detailed materials listing including details about the manufacturer and manufacturer's part number for each and every plant or equipment) for all materials that form part of the supply contract. Two hard copies and one electronic copy must be provided.

22.5 The parties agree to hold progress review meetings at site from time to time in the interest of speedy execution of the project and program. For this purpose, the Seller shall depute senior officer(s) from its head office to attend the site meetings.

22.6 Training of the Purchaser's personnel:

During erection and commissioning at the site the Seller and/or the Seller's Site Manager shall train the Purchaser's personnel in different areas such as techniques of erection, operation, maintenance of the plant and equipment items and/or other goods supplied by the Seller/s. If required by the Purchaser, the Seller shall arrange training for matually agreed period in other factories having same technology/equipments at his expenses.

After training the Seller shall issue to the Purchaser a training report. A suitable format for the training report shall be prepared by the Seller and approved by the Purchaser.

23.0 ERECTION, TESTS, COMMISSIONING AND ACCEPTANCE

23.1 The Seller shall ensure that the PERT / CPM charts including a "Detailed Implementation schedule" for erection, covering the total erection of plant and equipment items be sent to the purchaser. The Seller will, as soon as the detailed implementation schedule for the erection has been sent to the Purchaser, assist the Purchaser in estimating the tools, equipment and facilities required for performing the Purchaser's obligation.

23.2 The Technical Documentation shall be delivered by the Seller to the Purchaser in adequate quantity and high quality and in due time.

23.3 The Seller's supervisors shall bring with them Technical Documentation for their own use, if it is necessary.

23.4 Complete erection of all Equipment/Plant and equipment Items including Site assembly and welding of prefabricated large size tanks (including clarifier/vessels wherever specifically agreed), and structural members shall be carried out by the Seller in accordance with the designs, drawings, specifications, instructions and manuals, as provided by the Seller and approved by the Purchaser .

23.5 After completion of all civil works, the Site Managers of both contracting parties and their technical personnel shall duly check and inspect the works and sign a certificate certifying the completion and correctness of the civil works as well as conformity of the works with the drawings and Technical Documentation supplied by the Seller to the Purchaser.

23.6 When the Plant and equipment items have been wholly or partly erected the Site Managers of the Seller and Purchaser shall check and issue a certificate stating that the Plant and equipment is ready for mechanical tests and test runs without load (water running tests). The certificate shall be made in English.

23.7 The mechanical tests and the test runs without load must be separately conducted under the direction and instruction of the Seller's supervisors for individual machinery and complete Sections. A list of equipment being separately tested shall be agreed upon by the parties.

23.8 When Plant and equipment Items have been tested successfully, during the mechanical tests and the test runs without load, the Commissioning work is deemed to be proved and a certificate shall be issued and signed by the Purchaser.

23.9 Immediately after the termination of mechanical tests and test runs without load (water running tests) and issue of the certificate of the Commissioning the parties shall agree upon program and method for test runs with load to be carried out under Seller's supervision.

23.10 After the tests with load both contracting parties shall mutually agree upon the date of commencement of the performance test, as well as a program of

performance test and a notice thereof shall be entered into the “Site Progress Report”.

23.11 The performance of the machinery and equipment shall be deemed to have been achieved, if after commissioning, during the continuous trial of five (5) days per 22 working hours, the guaranteed performance parameters are achieved.

23.12 The Seller is to carry out such modifications to the plant and equipment as he considers necessary, in case the guaranteed performances are not achieved because of deficiencies in the plant and equipment items and/or design and/or instructions given by the purchaser. The Seller shall supply free of charge the additional parts or machinery which is considered necessary to achieve the said guaranteed performance. Such additional parts or machinery are to be Commissioned by the Seller immediately on arrival at the Site and new performance test shall be conducted in the same manner as described in this ‘Contract’.

24.0 PATENT RIGHTS, ETC.

24.1 Indemnity against infringement

The Seller shall indemnify the Purchaser against all actions, claims, demands, costs, charges and expenses arising from or incurred by reason of any infringement or alleged infringement of letters patent, registered design, unregistered design right, copyright, trade mark or trade name protected in the country where the plant and equipment is to be manufactured or erected by these or possession of any plant and equipment supplied by the Seller, but such indemnity shall not cover any use of the plant and equipment otherwise than for the purpose indicated by or reasonably to be inferred from the Specifications or any infringement which is due to the use of any plant and equipment in association or combination with any other plant and equipment not supplied by the Seller.

24.2 Conduct of proceedings

In the event of any claim being made or action brought against the Purchaser arising out of the matters referred to in this clause the Seller shall be promptly notified thereof and may at its own expense conduct all negotiations for the settlement of the same or any litigation that may arise there from. The Purchaser shall not, unless and until the Seller shall have failed to take over the conduct of the negotiations or litigation, make any admission which might be prejudicial thereto. The Purchaser shall accept the conduct of negotiations by the Seller of such litigation if Seller has first given to the Purchaser such reasonable security as shall from time to time be required by the Purchaser to cover the amount ascertained or agreed or estimated, as the case may be, of any compensation, damages, costs, charges and expenses for which the Purchaser may become liable. The Purchaser shall, at the request of the Seller, provide all available assistance for the purpose of any such claim or action and shall be repaid all reasonable expenses incurred in so doing.

24.3 Infringement preventing performance

If the Seller is prevented from performing the Contract, or the Purchaser is

prevented from using the plant and equipment in consequence of any infringement of letters patent, registered design, unregistered design right, copyright, trade mark or trade name and the party indemnifying the other in accordance with Sub-Clause 24.1 *(Indemnity against Infringement)* is unable within 30 days after notice thereof from the other party to procure the removal at his own expense of the cause of prevention then in the case of an infringement which is the subject of the Seller's indemnity to the Purchaser under Sub-Clause 24.1 *(Indemnity against infringement)* the Purchaser may treat such prevention as a default by the Seller and exercise the powers and remedies available to him under Clause 28 (Seller's Default).

25.0 ACCIDENTS AND DAMAGES

25.1 Care of the Plant and equipment

The Seller shall be responsible for the care of the plant and equipment or any item thereof until it is commissioned in accordance with the Contract.

25.2 Making good loss or damage to the plant and equipment

In the event that any part of the plant and equipment shall suffer loss or damage whilst the Seller has responsibility for the care thereof, the same shall be made good by the Seller at its own expenses.

26.0 LIMITATIONS OF LIABILITY

26.1 Mitigation of loss

In all cases the party establishing or alleging a breach of contract or a right to be indemnified in accordance with the Contract shall be under a duty to take all necessary measures to mitigate the loss which has occurred provided that it can do so without unreasonable inconvenience or cost.

26.2 Indirect or consequential damage

Except as expressly provided in Sub-Clause 15.1 (*Delay in Commissioning*) for the payment or deduction of liquidated damages for delay and except for those provisions of these conditions, hereby the Seller is expressly stated to be entitled to receive profit, neither the Seller nor the Purchaser shall be liable to the other by way of indemnity or by reason of any breach of the contract or of statutory duty or by reason of tort (including but not limited to negligence) for any loss of profit, loss of use, loss of production, loss of contracts or for any financial or economic loss or for any indirect or consequential damage whatsoever that may be suffered by the other.

26.3 Limitation of Seller's liability

In no circumstances whatsoever shall the liability of the Seller to the Purchaser under these Conditions for any one act or default exceed the sum stated in the Contract or if no sum is so stated, the Contract Price. The Seller shall have no liability to the Purchaser for or in respect or in consequence of any loss of or damage to the Purchaser's property which shall occur after the expiration of the warranty period except as stated in Sub-Clause 16.8 (*Latent Defects*).

26.4 Exclusive remedies

The Purchaser and the Seller intend that their respective rights, obligations and liabilities as provided for in these Conditions shall be exhaustive of the rights, obligations and liabilities of each of them to the other arising out of, under or in connection with the Contract or the plant and equipment, whether such rights, obligations and liabilities arise in respect or in consequence of a breach of contract or of statutory duty of a tortious or negligent act or omission which gives rise to a remedy at common law. Accordingly, except as expressly provided for in these Conditions, neither party shall be obligated or liable to the other in respect of any damages or losses suffered by that other party which arise out of, under or in connection with the Contract or the plant and equipment, whether by reason or in consequence of any breach of Contract or of statutory duty or tortious or negligent act or omission.

27.0 INSURANCE

The Seller shall arrange to insure the plant and equipment covering all risks including third party liability from the place of manufacture up to the commissioning of the Plant and equipment to be supplied under the Contract. A copy of the policy shall be provided to the Purchaser on obtaining the policy.

The Seller shall obtain All Risk Insurance for providing comprehensive insurance including medical & hospitalization and emergency evacuation cover to all Seller's Personnel deputed at the purchaser's site for the purpose under the Contract.

In the event any consignment is received in damaged condition or is lost in transit the Seller shall lodge a claim on the underwriters (Insurance Company) and shall simultaneously supply the replacement of plant and equipment, items or parts lost or damaged in transit or during commissioning, free of cost within the time so as to adhere to the date of Commissioning.

28.0 SELLER'S DEFAULT

28.1 Termination of Contract

The Purchaser reserves the right to terminate the whole or part of this Contract due to any or all the following on exhaustion of the Arbitration process:

1) If the Seller shall become bankrupt or insolvent, or have a receiver order made against him, or compound with his creditors, or being a corporation commence to be wound up, not being a members' voluntary winding up for the purpose or amalgamation or reconstruction, or have an administration order made against it or carry on its business under an administrator or a receiver or manager for the benefit of its creditors or any of them, the Purchaser shall be entitled:

    a) To terminate the Contract forthwith by notice to the Seller or to the receiver, manager, administrator or liquidator or to any person in

whom the contract may become vested, in which event the provisions of Clause 28 (*Seller's Default*) shall apply, or

b) To give such receiver, manager, administrator or liquidator or other person the option of carrying out the Contract subject to his providing a guarantee for the due and faithful performance of the Contract up to an amount to be agreed.

28.2 If the Seller shall assign the contract, or sub-let the whole of the Contract without the consent of the Purchaser and Seller has failed or refused to take remedial steps, or the Purchaser shall certify that the Seller:

a) has abandoned the contract, or

b) has without reasonable excuse suspended performance of the contract for 30 days after receiving a written notice from the Purchaser to proceed, or

c) despite previous warnings in writing from the Purchaser, is not manufacturing the plant and equipment in accordance with the Contract, or is failing to proceed with due diligence or is neglecting to carry out its obligations so as to adversely affect the performance of the Contract.

28.3 The Purchaser may give 21 days' notice to the Seller of its intention to proceed in accordance with the provisions of Clause 28. Upon the expiry of such notice the Purchaser may without prejudice to any other remedy under the contract and without affecting the rights and powers conferred by the contract on the Purchaser, terminate the Contract. Upon such termination the Purchaser shall be entitled to purchase plant and equipment in substitution for the plant and equipment which were to be supplied by the Seller or may itself complete the plant and equipment, in which event the Seller shall deliver the plant and equipment in its existing position to the Purchaser or as the Purchaser may direct, at the Seller's expenses.

28.4 As soon as practicable after the Purchaser has terminated the Contract the Purchaser shall, by or after reference to the parties and after making such enquiries as he thinks fit, determine the amount then due to the Seller on the date of termination and certify the amount thereof. The amount so certified is herein called '*Termination Value'*.

28.5 Payment on termination

The Purchaser shall not be liable to make any further payments to the Seller until the costs of completing the plant and equipment or obtaining substitute plant and equipment from elsewhere and all other expenses incurred by the Purchaser have been ascertained and the amount payable certified by the Purchaser (herein called '*the Cost of Completion*'). If the Cost of Completion when added to the total amount already paid to the Contractor upto the date of termination exceeds the total amount which the Purchaser certifies would have been payable to the Seller under the Contract on completion the Purchaser shall certify such excess and the Seller shall upon demand pay to the Purchaser the amount of such excess. Any such excess shall be deemed a debt due by the Seller to the Purchaser and shall be paid by the seller within 30 days from the receipt of

communication from the purchase to that effect. If such amount is not paid by the seller within the time stipulated interest @12% p.a. shall be charged by the Purchaser.

If there is no such excess the Seller shall be entitled to be paid the difference (if any) between the Termination Value and the total of all payments received by the Seller as on the date of termination.

29.0 PURCHASER'S DEFAULT

29.1 Notice of Termination due to Purchaser's default

In the event of the Purchaser

a) failing to pay to the Seller the amount due under any certificate of the Purchaser within 60 days after the date of its issue subject to any deduction that the Purchaser is entitled to make under the Contract, or

b) interfering with or obstructing the issue of any certificate of the Purchaser, the Seller on exhaustion of the arbitration process shall be entitled without prejudice to any rights or remedies under the Contract, to terminate the contract by giving 14 days notice to the Purchaser.

29.2 Payment on termination due to Purchaser's default

In the event of termination under sub-clause 29.1 (*Notice of termination due to Purchaser's default*) Purchaser shall certify the Termination Value of the Plant and equipment as on the date of termination. The Purchaser shall, on the application of the Seller accompanied by supporting details, also certify the amount of any expenditure reasonably incurred by the Seller in the expectation of the performance of, or in consequence of the termination of, the Contract to the extent that the same has not been included in the Termination Value. The Purchaser shall also certify in respect of the Contractor's loss of anticipated profit on the Contract on the difference between the total of the termination value plus the expenditure and allowance for profit exceeds the total of sums previously paid to the Seller and such certificate of payment shall be paid by the Purchaser within 30 days after the due date of issue.

30.0 DISPUTES AND ARBITRATION

If at anytime should there be any question, dispute or difference between the parties in respect of any matter arising out of or in relation to this tender/contract/ Agreement and any dispute related to any of the bank guarantees under this tender/contract/agreement , either party may give to the other party notice in writing of the existence of such question, dispute or difference and the same shall be referred to the Arbitration of a single Arbitrator appointed by Director Incharge, RSGSM whose decision shall be final and binding on both the parties. This reference to the Arbitrator shall be deemed to be a reference under the provisions of the Arbitration and Conciliation Act, 1996 and the rules made thereunder and any statutory modifications and re-enactments thereof that may be made from time to time and actually in force at the time of reference. The place of arbitration shall be at **Jaipur only**. The cost of arbitration shall be borne by the parties as may be decided upon by the Arbitrator. The award of the arbitrator shall be final and binding on the parties and be accepted by them. No

party shall take re-course to judicial courts including higher courts before exercising this clause.

30.1 Applicable law

The Contract shall in all respects be governed by and interpreted in accordance with the Laws in force in India.

30.2 If at any time, if there should be evidence of any lien or claim for which the Purchaser becomes liable and which is otherwise chargeable to the seller/contractor, then Purchaser shall have the right to retain and appropriate out of any payment then due or thereafter to become due, an amount sufficient to completely indemnify Purchaser against such lien or claim and if such claim or lien be found valid, then Purchaser may pay and discharge the same and deduct the amount so paid from any money which may be or may become due and payable to the seller/contractor.

31.0 FORCE MAJEURE

For the purpose of this Contract, "Force Majeure" means an event which is beyond the reasonable control of a Party, is not foreseeable, is unavoidable, and which makes a Party's performance of its obligations hereunder impossible or so impractical as reasonably to be considered impossible in the circumstances and includes but is not limited to war, riots, civil disorder, earthquake, fire, explosion, storm, flood or other adverse weather conditions, strikes, lockouts or other industrial action (except where such strikes, lockouts or other industrial action are within the power of the Party invoking Force Majeure to prevent), confiscation or any other action by Government agencies.

The failure of the Party to fulfill any of its obligations hereunder shall not be considered to be a breach of, or default under, this Contract in so far as such inability arises from an event of Force Majeure, provided that the Party affected by such an event has taken all reasonable precautions, due care and reasonable alternative measures, all with the objective of carrying out the execution of this contract as per terms and conditions of this Contract.

A Party affected by an event of Force Majeure shall notify the other party of such event as soon as possible, and in any case not later than fourteen (14) days following the occurrence of such event and shall **similarly give written notice of the restoration of normal conditions.**

ANNEXURE I (A)

SCOPE OF WORK

1. Design, manufacturing, procure, supply, erection & commissioning upto successful performance as per given parameter in **Annexure-III** for 1500 TCD cane crushing on 22 hrs. working capacity of sugar plant and 4.95 MW per hour co-generation power plant on turnkey basis. The capacity, efficiency and performance of the said plant for individual units should be guaranteed as per parameters given in the performance parameters for individual items.

2. All the machinery and equipments supplied should be brand new latest design fabricated as per ISI Standard tested construction first class material and workmanship along with material test certificates. Bought out items shall also have according to as per the given technical specifications and as per given Engineering standards **Annexure II** for construction material and latest design model.

3. The work is to be executed as per the terms & conditions stipulated in this invitation and also in the draft agreement.

4. Scope of Supply includes all the necessary equipments, plant & machinery with structural, staging, platforms, railings, approach ladders duly coated with protective paints both internally and externally as applicable. This also includes other tools & tackles required for the fabrication at site, adequate manpower quite conversant with the fabrication & erection work of such plant and machinery.

5. All foundation bolts, foundation wedges, alignment packings, liners etc. are also to be included in the scope of supply.

6. After the finalization of the order, the supplier has to prepare all civil foundations, structural & all the detailed fabrication drawings of each unit of plant & machinery, piping layout drawing, electrical layout drawing, isometric drawings, equipment layout drawings elevation drawings approved from Purchaser by appointing a competent person / agency as well as by concerned Govt. Authority and shall be submitted well in advance to purchaser & purchaser agency for prior examination & approval thereof.

7. All the consumables required for erection & commissioning like gas, all types of welding/ brazing or soldering rods, emery papers, grinding paste, hold lights graphite, Kerosene Oil, Rustoberg, back joints, steam packings etc. etc. are also to be included in the supply.

8. All types of tools & tackles like hoisting tools, chain blocks, pulleys, wire ropes hooks etc. to be arranged by supplier. All special tools required are also to be arranged by Supplier at his own cost. All staff including engineers, technicians, skilled, unskilled workers, Khalasi required for loading/unloading, fabrication, erection etc. should be arranged by supplier. The machinery & other equipments arrived at site should be properly stored at site. The transportation of machinery and equipments from the stored place to their respective position shall also be in the scope of supplier.

9. Technical services shall be also included in the scope of supply.

9.1 Project In charge: Supplier will retain a qualified & experienced and responsible project engineer/manager to supervise the installation & erection of the plant at site.

9.2 Training of the purchaser's personnel: Supplier shall arrange to train the purchaser's personnel regarding the process operation & maintenance of the plant being set up under the agreement at his own cost.

9.3 Startup services: Supplier will provide qualified staff for start up of plant and also during the performance period.

To provide for one year technical supervision staff :- At least for one year the supplier shall provide supervisory technical expert staff to assist the operation of plant. The technical staff to be provided for one year by the seller is enumerated as herein : (i) Boiler,Co-Generation plant and power export to grid (ii) milling section (iii) Boiling house. Under this clause at least 'five technical experts of above field (i, ii and iii) shall

be provided by seller for one year and simultaneously trained to the purchaser work man to operate the plant at full efficiency during operation.

10. After sales Services: Supplier will provide routine operation, field review & training updates. Supplier will also furnish a qualified field engineer to review unit operations & provide additional on-site training on demand by purchaser.

11. All bought out equipments should be offered for inspection before dispatch.

12. The supplier will prepare & submit to purchaser the PERT/CPM chart and time schedule accordingly. Supplier should ensure that they will maintain the time schedule as per the chart. The equipment delivery will strictly be in the order of erection requirements.

13. All materials of construction and fabrication shall be as per relevant ASME / ASA / AISI/ ASTM /ANSI /BS /IS / Standards and acceptable equivalent standards referred to in the Technical Specifications herein. They should also comply with standard and good engineering practices acceptable to the Purchaser & NFCSF.

14. The Supplier are fully responsible for any mishaps/casualty/fatal accidents of their employees during the contractual period of project. RSGSM will not be responsible at all for such mishaps whatsoever.

15. A tentative layout plan is available at **Annexure-XX**. However, a final layout plan for plant & machinery have to be provided by the Supplier within 15 days period after signing of Agreement of Contract.

16. Plant, Yard & street lighting are in the scope of supply.

17. Fire fighting system including accessories such as electronically driven pumps, jockey pumps, Diesel driven pumps, hydrant valves, RRL, hose pipes, MS pipes, Hose boxes, Hose reel, drum etc. complete in all respect, all types of fire extinguishers as per safety norms are also in the scope of supply.

18. Any other items are activities not specifically mentioned in our scope of work and equipment list and required for completion of project are in the scope of work.

19. First fill or oil and grease will be in scope of supply.

20. **Annexure- I (B)** is also within the scope of supply.

21. Main conditions of ENVIRONMENTAL CLEARANCE (available at RSGSM web site) are to be complied by seller:-

    a) Particulate Emission Level should not be more than 50 mg/Nm3.

    b) effective dust control, fugitive control system,fly ash storage/control system should be provided.

    c) Fresh water consumption should not be more than 390 m3/day

    d) Effluent generated should be treated to meet out CPCB/RSPCB norms.

    Further conditions which may be imposed by MoeF, CPCB, RSPCB or any other statutory body/authority during or before the successful commissioning or performance shall also be compiled by the supplier without any additional cost.

21. All the gun metal lined bearings, bush breakets of the moving machinery should be provided with proper lubrication arrangement.

22. All the drive unit of plant and machinery should be complete with suitable motor, starter, reduction gear units V-belt pulleys, V-belts, coupling guards, Bed plates etc. as per duty conditions.

23. Boiler feed water & PRDS station flow diagram sheets may be enclosed indicating the pressure, temperature and quantities where ever applicable at inlet and outlet of each unit involved duly examined as per specification of the units being offered.

24. AC VVFD system should be provided where ever suitable

.

25. Power evacuation system from 11 KVA transmission line including 11 KVA to 33 KVA stepup transformer and other accessories from factory power house to factory switch yard is in scope of supply. Further transmission of 33 KVA shall be in seller's scope this system should be installed as per direction of Electricity authority of the state.

26. In view of the turnkey basis project battery limit shall be likewise of such projects as under subject to the completeness of the plant in all respects :-

i) Water Supply will be given at one point by purchaser from where seller shall carry through appropriate method up to the required place or site.

ii) Electric Power Connection of RSEB supply will be given at one point by purchaser from where seller shall make appropriate aragement to make power supply up to different unit of plant and machinery or where ever required .

iii) Discharge/storage arrangement for By –product like press mud, molasses and bagasse shall be provided by the seller.

ANNEXURE I (B)

TECHNICAL SPECIFICATION OF PLANT AND MACHINERY

Specification of 70 TCH (1500 tonnes/22 hrs.) gravity flow type cane sugar plant with a provision for expansion of capacity up to 2500TCD, for production of plantation white sugar process.

1.0 Cane Milling Plant :

1.1 Cane Weighment

Install 3 Nos. of weigh bridges of 50 tonnes, 30 tonnes and 20 ton capacity respectively. The bridges shall be fully computerized for trucks, trolleys and bullock carts. Size of the platform should suit the weighting of truck, trolley and bullock cart respectively. Cane weighbridges should be connected to centralized control system of cane weighment monitoring system. The weigh bridges should be load cell type & have digital display of load also and accuracy of minimum ± 1 kg. be provided. The platform size should not be less than 3 meters wide and 10 meters in length for each weigh bridge.

1.2 Cane Handling and Feeding Arrangement

Two bridge with one trolley for each of three motion, having hydraulic grab system (5 T SWL Capacity).

The crane shall be of 3 motion electrically operated overhead unloading crane conforming to class IV IS; specifications and capable of 24 lifts per hour. In each lift hydraulic grab shall lift at least 2.5 tonnes of cane. The crane shall be complete with its accessories, gantry columns, attendant plat-form along the length of the gantry on sides, 2 Nos. stair cases, motors etc. It shall be heavy duty type and suitable for continuous outdoor working. All operations shall be electrically controlled from the operator's cabin. The crane gantry span shall be 22meters. The crane gantry shall be 30 meters in length with gantry columns 10 meters apart for initial capacity and shall be extended by 10 meters for ultimate capacity. The crane bridge shall be of box type construction made of IS-2062 or equivalent. The gantry columns should have 'L' shape construction but the 4 nos. end columns should have double L construction at 90 deg. The end columns should be provided with tie beams on each end.

If there is more than one bridge, each bridge should have separate down shop leads and separate ACB. The operators cabin shall be provided with fan, ladders, glass panels and windows etc. There should be no open gearing. All wheels shall be provided with ':L' type altitude housing.

The crane columns shall be extended by 2 meters for the shed to be provided at a later date by the purchaser. The structure of the gantry shall be of adequate strength to provide additional crane of identical specifications for expansion to ultimate capacity.

Design Code : I.S. 3177 & 807

All electric motors shall be of crane duty T.E.F.C. enclosures suitable for 300 operations per hour with following specifications :

Particulars	Type of motor	H.P.	Rating	Duty
Hoisting Drum Drive	Squirrel cage 25	1 hour		S4
Holding Drum Drive	Squirrel cage 25	1 hour		S4
Long travel drive (2Nos)	Slip ring	5+5	½ hour	S4

Cross travel drive	Slip ring	7.5	½ hour	S4

For operation of these motors push button type panel shall be provided and its location shall be in the cabin attached to the trolley.

The following speeds shall be provided for various motions :

Hoisting	:	18 meters/minute
Holding	:	18 meters/minute
Long Travel	:	25 meters/minute
Cross Travel	:	25 meters/minute

The height of the lift shall be 10 meters. All gear boxes shall be totally enclosed, dust proof, helical type gear and shall be designed with a service factor of 2.0. All couplings shall be of flexible gear type, with periodically greasing arrangement. All brakes shall be of electro hydraulic thruster operated type. The ratio of pulley dia (PCD) to wire rope dia not be less than 20.

A suitable shed shall be provided on the trolley.

1.3 Cane Carrier and Preparatory Devices

a) Cane Carrier

One cane carrier 1525 mm wide and horizontal loading length 30 mtrs. shall be provided. The length of its inclined portion shall be such that it gives an inclination of 16 deg. for the leveller with a minimum length of 6 meters having a slope of not more then 6 deg. before fibrizer. It shall have suitable elevation to suit the installation of fibrizer. It shall have three strands of chains of 150 mm pitch. The breaking strength of the chains shall be minimum 40,000 kgs. The cane carrier and its structure shall be of all steel construction, the slats 6 mm thick shall be as per IS: 8236 and fastened to chain by bolts and nyloc nuts or by bolts and check nuts. The horizontal portion of the carrier shall be arranged below the ground level in such a way so that the sloping sides of the carrier is about 300 mm above the ground level. Space of minimum 750 mm shall be left in the pit on either side of the carrier for inspection and cleaning purpose. Arrangement for adjusting the clearance upto 50 mm between tip of knives and the slats in the cane carrier shall be provided in the inclined portion. The carrier frame work shall not be less than 6 mm thick and mild steel plate extending along the complete length of the carrier except at the place of cane leveller where the thickness should be 10 mm for about 2500 mm length. The frame work shall be adequately stiffened at the top and bottom by angle iron welded to the side plates. The side plates shall be bolted to and supported by rolled steel 150 mm x 75 mm channels or sections of equivalent strength and be provided with base plate of ample area reinforced by gusset plates or angle plates. Two foundation bolt holes would be provided in each base plate. The columns in the immediate vicinity of the cane knife set shall be 225 mm x 75 mm double channels or sections of equivalent strength. All columns at drive end should be adequately braced by angle cross pieces of heavy section secured by gusset plate and bolts or by welding. Three longitudinal 150 mm ISMB runners with renewable 6 mm thick spring steel wear pads would be bolted on the top side of the cross pieces to support the cane carrier chain rollers. The distance between the adjacent supporting columns should not exceed 2.5 meters. The runners would be lowered slightly where the chain arrives at and leaves the runners. 6 mm x 75 mm flat iron should be tag welded/bolted on the side plates of the cane carrier so that cane carrier slats touch the flat iron only to avoid wearing on side plates.

The return side of the apron can slide on the guide angle runners with 6 mm thick spring steel wear flat provided the slats are equipped with renewable wear pads or alternatively

be supported on C.I. idler pulleys having 280mm dia and 60mm width and secured on 75mm dia MS shaft running in G.M. Bushes fitted in C.I. Brackets with grease cups fastened to each set of supporting columns. Side plate be provided inside the columns to guide the slats.

The carrier chain driven by means of cast steel sprockets having machine cut teeth atleast 16 in number and mounted on minimum 170 mm central dia. head shaft of 40 C8 quality or equivalent and shall run in 140 mm size split gunmetal line cast steel plummer block. The head shaft would be driven by machine cut gears of adequate strength. The columns under the head shaft and carrier drive shall be extra heavy section to withstand vibrations. At the non-driving end of the cane carrier, the chain shall be mounted on cast steel sprockets having machine cut teeth on minimum 125 mm central dia tail shaft of 40 C8 quality or equivalent running in minimum 100 mm size gun metal lined cast steel. Housing with slide rails and tension bolts for tightening the chains

The head and tail shafts be hot forged and ultrasonically tested.

Pneumatic steaming arrangement to be provided on the head shaft of cane carrier to clean slats and chain to remove cush cush from the carrier chain.

b) Rake Carrier for Prepared Cane

Rake type conveyor shall be of steel construction having suitable width trough to accommodate 1525 mm rake width and of suitable length to suit minimum feeding height 2.5 mtrs above top roller of mill. The inclination of the rake carrier shall be 45 deg. max. and the boot having no horizontal portion. Tail shaft center of rake carrier shall be in line with head shaft centre of cane carrier. The rake carrier and its structure shall be of all steel construction with two strands block type forged chain of 229 mm pitch chain having 60,000 kgs. breaking strength having locking arrangement with nyloc nuts or check nuts. Flights would be made out of 6 mm thick mild steel plate of suitable shape and profile and welded on pipe or box construction beams. These beams shall have suitable arrangement for fitting with the chain attachment at every fourth link with the help of bolts, nyloc nuts or check nuts

The rake carrier should have runners of channels angle iron with 6 mm wear flats and 8 mm thick mild steel bottom trough plate with stiffeners and should be supported on steel channel columns of adequate strength provided with rigid base plate. The columns should be adequately braced to avoid vibrations. The elevator chain shall be driven over two cast steel machine cut sprockets mounted on 150 mm central dia. head shaft of 40 C8 or equivalent quality running in minimum 120 mm size gun metal lined cast steel bearings secured to head shaft columns. The tail shaft of minimum 125 mm central dia. 40 C8 or equivalent quality should have two cast steel sprockets having machine cut minimum 14 No. of teeth and would run in minimum 100 mm size gun metal lined, cast steel plummer blocks attached to the rake carrier boot. Space of minimum 750 mm on both sides at tail end to be kept. The prepared cane from fibrizer shall be transported to the belt conveyor installed at elevated portion.

The portion of the chain below the fibrizer shall be suitably covered to avoid damage due to prepared cane thrown by the fibrizer. The tightening arrangement shall also be provided with tail shaft bearings.

c) Cane Carrier / Rake Carrier Drive

(i) Cane carrier : 50 B.H.P. – AC VVVFD Type
(ii) Rake carrier : 30 B.H.P.- AC VVVFD Type

Each carrier shall have a constant torque characteristic over operating speed range. The motor should be AC VVVFD type to be coupled to helical gear box having service factor of 1.7 with open gearing drive to provide following apron speed.

Cane carrier : 3 meters to 10 meters/ minute.

Rake carrier : 10 to 30 meters/minute.

d) Belt Conveyor between rake carrier & 1st Mills

A suitable length of belt conveyor shall be installed between rake carrier and 1st mill. The effective width shall not be less than 1525 mm. A suitable electromagnetic type tramp iron separator to be provided over the belt conveyor to remove a minimum 25 kg of iron pieces from below the bed of 300 mm depth of prepared bagasse. It should be provided with suitable AC VVVF FD motor of 15 HP & helical gear box. The portion of the belt conveyor should be non-magnetic where electro magnet is installed.

The prepared cane from rake carrier shall fall on this belt conveyor. Thus belt conveyor shall carry the prepared cane to Donnelly chute of 1st mill. It should be complete with staging structure & walk way.

e) Cane Preparation

i) Cane Chopper

One cane chopper set having not less than 24 knives secured to cast steel hubs of IS :1030 grade 280 – 520 W mounted on a forged steel shaft of 140 mm dia.of 40 C8 quality .The dia. over the tips of knives shall not be less than 1400 mm. The knife shaft shall be supported at 120 mm bore, heavy duty self aligning double row spherical roller bearings with adopter sleeve in steel plummer blocks. The knives shall be of special shock resisting steel having hard faced cutting edges, hardness 45 to 48 HRC and tenoned into the hubs eliminating the shear on the bolts which should be of EN8 steel or of equivalent strength with nyloc nuts. The knives shall conform to IS ; 8461. A suitable fly wheel of CI grade, FG 260 IS-210 duly machined and well balanced shall be provided at the outer end of the shaft.

Cane chopper set shall be driven by a continuously rated drip proof / screen protected slip ring motor of 150 B.H.P(LT) and 600 R.P.M. synchronous speed at a total slip of 15 percent. It shall be directly coupled by means of geared type coupling capable of transmitting 150 B.H.P. continuously. The motor shall be complete with starter and suitable buffer resistance.

The knife set shall be installed on the horizontal portion of the carrier before leveller and clearance in between the slats and knives tips shall be 850 mm. The knife set shall be totally enclosed by suitably reinforced hood of 10 mm thick and mild steel plate attached to the cane carrier frame work and provided with suitable swing flaps and bolted doors at top of the hood.

ii) Cane Leveler

One cane leveller set having not less than 36 knives secured to cast steel hubs of IS:1030 Grade 280 – 520 W mounted on a forged steel shaft of 200 mm dia. of 40 C8 quality. The dia. over the tips of knives shall be not less than 1400 mm. The knife shaft shall be supported at 150 bore, heavy-duty self-aligning double row spherical roller bearings with adopter sleeve in steel plummer blocks. The knives shall be of special shock resisting steel having hard faced cutting edges, hardness 45 to 48 HRC and tenoned into the hubs eliminating the shear on the bolts which should be of EN8 or of equivalent strength with nyloc nuts. The knives shall conform to IS. 8461. A suitable flywheel of CI grade, FG 260

IS-210grade duly machined and well balanced shall be provided at the outer end of the shaft.

Cane leveler set shall be driven by a continuously rated drip proof / screen protected slip ring motor of 150 B.H.P(.LT) and 600 R.P.M. synchronous speed at a total slip of 15 percent. It shall be directly coupled by means of geared type coupling capable of transmitting 150 B.H.P. continuously. The motor shall be complete with starter and suitable buffer resistance.

The knife set shall be installed on the inclined portion of the carrier and be provided with a suitable device for adjusting clearance in between the knives tip and slats from 250 to 300 mm. The knife set shall be totally enclosed by suitably reinforced hood of 10 mm thick and mild steel plate attached to the cane carrier frame work and provided with suitable swing flaps and bolted doors at top of the hood. Provision for identical additional motor drive arrangement with load balancer on other end should be made for ultimate capacity.

iii) Swing Hammer Fibrizer

Swing hammer type - located at the head end of carrier, to suit 1525 mm wide cane carrier having not less than 90 hammers. Weight of each hammer shall not be less than 22 kg.

The rotor shaft shall be heavy duty minimum 300 mm dia at the hubs and 220 mm dia. at the bearing journals and shall be 45C8 as per IS 1570. The fibrizer should have detachable type domite type of hammer tips having size 90x90mm. The hammer shank shall be made of special shock resistant alloy steel and secured through 50mm dia SS pins. The hammer shank and fibrizer disc should have GM bushes to suite SS pins. The hubs shall be fabricated from minimum 60mm thick MS plates and fitted on rotor shaft.

Anvil plate shall be pocketed design, having wrap angle of 160 deg Minimum. The base plate thickness of the anvil shall be minimum 25 mm. Hard facing on the anvil-working surface shall be having minimum hardness 600 BHN. Anvil plate shall have provision for adjusting the anvil clearance. A suitable Floating flap of 20mm thick to be provided , at the entry point of the anvil.

Rotor shall be supported on two heavy duty self aligning double row spherical roller bearings with adapter sleeve in split type C.S. plummer blocks with water cooled arrangement . Tip dia. of hammers shall be 2000mm speed when running at 750 RPM motor Syncronous speed.

The fibrizer rotor shall be completely covered by reinforced mild steel fabricated hood made out of 12 mm thick plate attached to the cane carrier frame work and will be complete with deflector plate, adjustable mild steel fabricated anvil plate, front adjustable cover, deflector plate of 20 mm thick with 2.5 thick SS lining. Rotor bearing plummer blocks shall be cast steel. Mist/pressure lubricating system for bearings shall be provided. Provision shall be made for adjusting of anvil plate setting. Pressure lubrication system should have provision for 2 Nos. Pumps. 2 Nos coolers (one standby) oil reservoir pressure gauge, piping, return line, needle valve fitting etc. And auto starting of stand by pump.

The Fibrizer shall be driven by 1 No. continuously rated 750 HP SPDP slipring motor (HT) of 750 RPM synchronous speed at a total slip of 15%. The motor shall be directly coupled to one end of the fibrizer shaft by means of gear coupling capable of transmitting 750 HP continuously. The other end of the fibrizer shall have provision for installation of additional identical motor by means of flexible gear coupling at later stage for the ultimate capacity. The motor shall be complete with load balancer stator rotor starter, Technomic make slip regulator so that the starting current does not exceed 300% of full load current and

suitable buffer resistance. The prepared cane must have P.I. of minimum 85%. The rotors of chopper leveler and fibrizer should be dynamically balanced.

f) Auto Cane Feed Control System

The automatic cane feeding control system shall be installed on cane carriers. The system shall ensure the uniform feed rate to the 1st mill with provision to change the feed rate at any time having a variation not more than ± 5 % set rate. Primary cane carrier shall follow speed of secondary cane carrier in a fixed ratio. Load of all cane preparation devices shall override the speed signal of each cane carrier. When load of any cane preparation device exceeds 80% of rated load, the speed of that cane carrier shall be proportionately reduced. If load exceeds 100% of rated load, that cane carrier will stop. It will restart automatically when overload condition on that cane preparation device becomes normal. These overload settings shall be adjustable from the control panel. The system shall have the following provisions.

Sensors :For load sensing of cane preparatory devices such as chopper, leveller, fibrizer and 1st mill, suitable current transformers / two wire electronic analogue pressure transmitters with capacitance sensing technology with 4-20 m ADC output and configurable for calibration to the required pressure ranges within the designed pressure span of the transmitter. In addition to this level sensing of prepared cane at Donnelley chute should be provided.

Control Action :The system should be provided with two control actions i.e. proportional and ON-OFF control actions. Proportional control as per the 1st mill load. ON-OFF control as per the high load settings of the cane preparatory devices and first mill.

Set Points : Following settings are to be provided,

a) For loads of various cane preparatory devices and 1st mill motor, precision load setters of 1 K 10 Turns helipots with dial knobs.
b) For average height and feed rate precision 10 K 10 Turns helipots with dial knobs.

Visual Indication : Coloured lamp indicators for the high set load values.

Carrier Speed Adjustments : The speed of the cane carriers can be adjusted from zero to the rated RPM with the settings provided on the control panel at operators console.

Proportional control at speed of carriers (cane carrier and rake carrier)as per 1st mill load, preparatory devices load and blanket thickness of cane carrier shall be provided.

Indicators :Analogue load indicators (i.e. current or pressure indicators) and speed indicators.

Power Supply :230 V AC, 50 Hz

g) Milling Plant

i) Mills

For 1500 TCD : 4Nos., three roller mills having nominal dia. 765mm x 1525mm long, toothed type under feed rollers (TRUF) and Donnelly type chutes

Each mill roller shall be minimum nominal dia. of 765 mm x 1525 mm length and journals of minimum 380 mm dia x 475 mm length. The roller journal center should not be less than 2300 mm. The rollers shall be of coarse grain cast iron having hardness 180 - 210 BHN. The composition of the shell material shall conform to IS : and shall be :

Total carbon	:	3.20 to 3.6 percent.
Manganese	:	2.2 to 3.2 percent
Silicon	:	1.2 to 2.2 percent
Phosphorus	:	0.5 percent Max.
Sulphur	:	0.15 percent Max.

The cast iron shell shall be hot shrunk on forged steel shaft of 45C8 quality conforming to IS: 1570 or equivalent having a minimum tensile strength of 63 kg/mm2. All the shaft shall have square ends, not less than 300 mm square. Top roller shall be fitted with stationary collars and juice rings in two halves. The bottom roller shall be provided with juice rings and removable guards to prevent entry of juice into the bearings. The cast steel crown pinions shall have minimum 360 mm face width and 17 machine cut teeth conforming to IS :2708 Grade 3, keyed to roller shaft and suitable mild steel guards and troughs.

The headstocks shall be of cast steel as per IS:1030 grade 280/520 W. These will be of king boltless type. Removable gun metal wearing plates on feed side as well as discharge side and with lubricating arrangement between top roller bearings and wearing plates shall be provided. The top and side caps shall be of cast steel as per IS:1030 grade 280/520 W and shall be securely locked in position for quick assembly. Stainless steel strip of 8 mm thick shall be provided in the side roller bearing face of the head stock. The eccentricity between top roller bearing centre and hydraulic cap centre shall be kept suitably towards the feed side of the headstock, except in case of inclined headstock.

All rollers shall be coated with surface roughening electrode material and its bearings shall be of cast steel with gun metal and with water cooling arrangement. The side roller bearing shall be of cast steel housing with renewable gun metal liner as per IS: 318.

The housing shall have water-cooling arrangement. All top roller bearings shall be interchangeable. Similarly all feed side and discharge roller bearings shall be inter changeable by their bearings.

The mills shall be provided with cast steel trash beam as per IS:1030 grade 280 / 520W and supported on heavy steel brackets with pivoted journals fitted in the head stocks and adjustable by means of tie rods and fitted with removable cast steel trash plate as per IS:1030 grade 280/520W, bolted by high tensile bolts and nuts. Top roller scrapers shall be of floating type. Scrapers for top and discharge rollers shall have renewable cast iron tips. Messchaert groove scrapers shall be of spring steel secured on square shaft and supported on cast steel/fabricated steel blocks and provided with lever or other suitable adjusting device. All mechanical parts of mill shall be designed for a crush rate of 2500 TCD.

Each mill shall be provided with hydraulic loading system, consisting of hydro-pneumatic accumulator, one for each of the journal of the top roller, one extra as spare and accessories such as pumping set, receiver tank, gauges, remote control panel and roller movement indicator electronic type . The dia. of the hydraulic ram for top cap shall be minimum 300mm.The hydraulic system shall be designed for a oil pressure of 280 kg/cm^2 g.

One centralized mill lubrication system having positive displacement pump at about 400 bar pressure having dual delivery lines made of SS 304 x 2mm thick (DIN standard) of 16mm dia for main line on both sides of the mills with changeover valves, relief valves and distributors with delivery adjustment arrangement with feed line of 8mm dia SS x 1mm thick provided to the bearings, complete with control panel pressure gauges and audio/video alarm with suitable timer arrangement for controlling pump operations.

Juice trough under the mills shall be made of 5 mm thick SS 409 M. The trough shall be bolted to the headstocks with stainless steel bolts and copper washers. Joint shall be suitably sealed to prevent any juice leakage.

All the mills shall be high set so that no part of the juice tank pumps are situated below floor level. All the mills shall have common gangway on both sides having width not less than 750 mm with chequered plates or gratings and minimum four number staircases one for crusher side, one for bagasse elevator side and two from mill drive platform, along with the cross connections after each mill. One common gangway for all interrake carrier drive platform to be provided.

Access from mill platform to rake elevator drive platform with suitable cat ladders shall be provided. All gangways and staircase shall have hand railings. Access from magnetic belt conveyor to inter rake carrier drive platform should also be connected.

ii) Toothed type perforated underfeed roller: 4 nos. having nominal dia of 800 mm and 1525 mm length

The shaft shall be 40 C8 quality conforming to IS 1570 and of 200 mm central dia. and supported by means of bush bearing of minimum 150 dia bore x 225 mm length. The under feed roller shall be driven by top roller through gears to give surface speed of about 10% higher than the mill roller surface speed. It shall have arrangement to adjust the setting in horizontal & vertical axis by plus-minus 25 mm.

Space to be provided in the layout between fibrizer and first mill for installation of zero mill of next higher size.

iii) Donnelly type Chute : 4 Nos.

The Donnelly type chute fabricated out of 6 mm thick of SS 409 M shall be provided. It shall have arrangements to adjust the blanket thickness from front as well as back side. The height of each chute shall not be less than 2.5 meters and its inclination not less than 80 deg. with the horizontal. Side plate of chute shall have full height transparent sheet to see the bagasse level. First mill chute shall have electronic level sensing device to control cane feeding. Suitable indicators shall also be provided to indicate bagasse level in other mill chute. Level sensing device should have on off control of the intermediate rake carrier drives and sequencing interlock.

iv) Rake type Intermediate Carriers : 3 Nos.

Rake type inter carrier, between the mills whose centre distance shall not be less than 8000 mm be provided. The width of the carrier trough shall be suitable to accommodate 1525 mm rake width and its cross section suitable for handling bagasse of ultimate crushing rate with imbibition upto 300% on fibre. It shall be similar in construction as described under rake carrier item 1.3 (b). Trough should be provided with SS-409 M plate of 3.0 mm thick at inside bottom duly tag welded.

The inter rake carriers shall have runners of angle iron / channel with 6 mm spring steel wear flat and 8 mm mild steel bottom trough plate with stiffeners and be supported on steel channel column provided with rigid base plate. The columns shall be adequately braced wherever necessary.

Each inter rake carrier drive shall consist of the TEFC motor of 25 BHP, 1440 RPM with enclosed helical speed reducer with open gearing, fluid coupling, common bed frame, motor shall be with D.O.L. starter etc. The linear speed shall not be more than 30 m/minute. The rake carrier chain shall be 229 mm pitch block type chain having breaking strength of minimum 60,000 kgs. driven over two cast steel sprockets having 14 No. cut teeth mounted on 130 mm central dia. head shaft of 40 C8 quality conforming to IS:1570 or equivalent and running in 100 mm size split gun metal lined cast steel bearings secured to head shaft columns. The tail shaft of 100 mm central dia. and of 40C8 quality or equivalent shall have two cast steel or fabricated sprockets having machine cut teeth and shall run in 80 mm size gun metal bush lined cast steel plummer blocks attached to the elevator boot. Its bearing shall be outside the elevator trough. The tightening arrangement shall be provided with the tail shaft bearings. The angle of the rake carrier shall not be more than 45deg. The rake carrier shall be designed for head end discharge of bagasse to the Donnelly type chute.

v) Mill Drive

Each mill shall be driven by a continuously rated 400 HP AC VFD drive. The motor base speed shall be 1000 RPM and shall have constant torque characteristic between 20% to 100% base speed and constant power characteristic between 100 to 110% of base speed.
The specification of motors shall be as under

Quantity	4 Nos.
Rating	400 HP, 1000 rpm base speed, 3 phase, squirrel cage AC induction motor. Suitable for 12 pulse drive.
Main Supply	3 phase, 11 KV / 415 V / 415 V through inverter duty transformer having one no primary dual wiring delta connected & two Nos. secondary wirings (one delta & one star connected).
Protection	IP-55
Ventilation	CACA
Speed Range	20 % - 110 % of base speed
Constant Torque Operation	20 % - 100 % of base speed
Direction of Operation	Bi-directional
Mounting	Horizontal foot mounting
Class of Insulation	“F” but temp rise limited to class ‘B’

Design Ambient Temperature 45 deg

The specification of the VFD shall be as under

Quantity 4 Nos.

Each VFD shall be of 12 pulse, 400 HP ACS 800 or its equivalent, suitable for incoming supply of 415 V, 50 HZ, AC. Each inverter cubicle shall be fabricated for 14/16 SWG.

CRCS sheets, free standing, passivated & painted with anticorrosive paints. Each drive shall be complete with all the salient features including protection for its drive.

The cubicle shall house all the switch gear & their protectors, controls, thyristor, regulating modules, interlocking relays & filters etc. All necessary meter indicators, annunciators, controls etc. shall be neatly arranged on cubicle front doors with neoprene gaskets on all edges of the panel . Ventilation openings shall be provided at the top of the panel & on side covers by louvers suitably covered by wire mesh.

Drive shall have provision for bi-direction speed regulation & will be +/ - 1 % of the base speed by tacho-feed back . The panel will have the facility to accept 4 – 20 m A signal for speed setting in local auto mode & to have control from PLC /DCS System.

Each of the drives shall be provided Ammeter, Voltmeter with selector switch, speed indicators, KWH meters etc.

The pressure ventilation system with electric motor drive blower with filter shall be provided for panels. One common control desk with all the controls shall be provided for each motor to be controlled common desk.

Specifications of Inverter Duty Transformers -for 12 pulse drive application

Quantity	2 Nos. (Each suitable for 2 nos. mill drives)
Rating	Continuous, 1.25 MVA each
Primary Voltage	11KV +/- 10 % (winding delta connected)
Secondary Voltage	415 V /415 V (winding delta / star)
Impedence	5.95 %
Vector	D doy 11

The transformer shall be complete with fittings & accessories like conservator , MOG , BREATHER , Bucholtz relay , with contacts etc for alarm & trips , pressure relief devices, thermometer packets , OTI & WTI, Valves , earthing terminals , cooling accessories , bi-directional flanged rollers with locking & bolting device for mounting on rails , air release devices , inspection box , marshall box etc .

Each transformer feeder shall have incoming supply 400 amp 11 kv VCB, kw meter, kw h meter an ammeter , instantaneous o/c relay , earth fault relays , ID MT over current relay .

The electrical installation for mill drive motor, inverter panel and transformer etc. shall be complete in all respect.

Centrally Air conditioning system and equipment of control room for mill drive inverter penal shall be supplied by the seller. The room, civil work shall be provided by purchaser

vi) Mill Gearings

All the mills shall be driven through enclosed planetary type, foot mounted reduction gear boxes, each suitable for transmitting 400 BHP continuously, under shock-load conditions at base speed of the motor.

The total gearing ratio should be so selected that mill should have a surface speed of 12 m/min. at motor base speed.

The gear boxes should have service factor of 2.50, suitable base frame, forged steel shaft, and centralized high pressure lubrication system to be provided. The gear box out put shaft shall be connected to the mill through suitably designed rope coupling.

(h) Imbibitions Equipment and Mixed Juice Pump

(i) Juice Screening Arrangement

Rotary Screen for juice screening- suitable for ultimate capacity – One No.
For separating the cush – cush / fine bagacillo from the mixed juice, generally to the following specifications:

1. Size of the rotary screen	:1800 mm dia x 3600 mm length
2. Juice handling capacity	:125 m3/hr.
3. Juice screen slot opening	:0.5mm.
4. Drum speed	:1 to 1.5 m/sec
5. Drive arrangement	:Positive through transmission chain and chain wheels or directly coupled, minimum 7.5 HP
6. Material of construction :	
a. Screen drum	:Wedge wire screen of SS 304 welded type having slot width 0.5 mm
b. Support and thrust rollers	:METALON / Polyuvethene/ Carbon steel case hardened supported on antifriction bearings
c. All juice wetted parts like juice tray, splash guards, inlet feed box, drum shell at inlet and outlet, cush-cush, discharge chute.	:SS 409 M
7. Water sparging system	:For cleaning and sanitation, to spray hot water through jet nozzles during operation with provision of auto on/off at nozzle header min 4 kg/cm2.

The Rotary Screen shall be mounted on suitable steel staging, having platforms around the drum at right angles to the mills so as to directly discharge the cush-cush in to the rake elevator between 1st mill and 2nd mill.

8. Control Philosophy for Operation of Rotary Screen

A) Hot Water Sparging

The screen drum should be cleaned at regular intervals by spraying weighed hot water (80 to 85 deg. C) at adequate pressure (min.4kg/cm2 at nozzle header) through spray nozzles. The hot water should be pumped by a separate high pressure sparging pump. The starter panel of the pump should be provided with control circuit having timers to 'START' the pump at pre-set time intervals of every 5 to 10 minutes. The pump remains 'ON ' for about 30 to 60 seconds.

Alternatively

Screened Juice Sparging

The screen drum should be cleaned at regular intervals by spraying screened juice at adequate pressure (min. 0.5 kg/cm2 at nozzle header) through spray nozzles. The juice is tapped from screened juice pump delivery line and provided with a solenoid control valve, with control circuit to spray the juice at a pre-set interval for a set time period.

In this case, a separate pipe header is required for sanitising the screen with either hot water (80 to 85 deg C at 1.0 bar pressure from imbibition water system or with exhaust steam (125 deg C at 0.5 to 1.0 bar pressure) at least once in a shift for a period of one to two minutes

B) Caustic Soda Solution Cleaning

1. In order to clean accumulated scum of gummy, waxy matter, a spray of dilute caustic soda solution (about 20 %), approx. 300 to 500 litres, is applied on to the screen drum once in a week. Caustic soda solution pumped with the help of the same water-Sparging pump. It is necessary to stop the feed juice going to the screen, at this time. Dilute caustic soda solution should be allowed to react on the scum of gummy, waxy matter and later, hot water / screened juice should be sprayed to wash away the loosened scum as well as traces of caustic soda solution. The caustic soda solution is to be re circulated by installing a separate tank by installing a diverter and valve , so that this caustic soda solution does not add alkalinity to the juice.

2. As an additional precaution, screen drum should be inspected and bagacillo, gummy, waxy matter accumulated & hardened in the screen slots over the period of time, should be thoroughly cleaned with brush & caustic soda dilute solution during the regular cleaning shut – down.

(ii) Juice Tanks and Pumps

The juice from mill No2,3 and 4 shall be collected in individual cylindrical whirler tank with conical bottom of 750 mm dia and 1100 mm height made of 4 mm thick S S 409 M connected to mill juice trough through 4 mm thk. SS 409 M gutter. The juice from mill No.1 shall be collected from individual mill juice trough to SS 409 M gutters outside the mills and then connected to individual cylindrical whirler tank with conical bottom. All whirler tanks shall be interconnected with gutter and flap at top level. The juice from whirler tanks of mill number2, 3 and 4 shall be pumped through individual choke less pump capable of pumping 40m3 per hour of juice having minimum 50% solids at 15 meters head to imbibition juice distribution trough through a suitable surplus feed back device installed above the level of gangway at the mills to ensure steady and uniform rate of imbibition. The mixed juice from Mill No.1 shall be collected in individual tank and be pumped through separated chokeless pump 2 Nos. with full bore discharge and each capable of pumping 90 m3 per hour of juice having minimum 50% solids at 15 meters head to rotary screen. All the above pumps shall be designed to operate at about 960 rpm.
The screened juice shall be collected in a 4 mm thk SS 409 M cylindrical tank of $10m^3$ capacity. Two strained juice pumps (one as stand by) each of 90 m3/hr capacity and 60 mtr head shall be provided for pumping the screened juice. Screened juice pumps to be provided with AC VVVF variable speed motor.

All juice pumps viz. Imbibition, screened and unscreened to have SS-409 bodies and with SS-409 impellers and SS shafts. All the juice pumps should have delivery lines not less than 150mm. and shall operate at 950 RPM.

iii) Imbibition water Pumps & Control System

One magnetic type flow meter indicating integrating and recording type suitable to measure upto 40 m3/ Hr. at 80 deg C. The water will be discharged in a closed overhead receiving tank of 15 cu.m. suitable capacity fitted with two imbibition water pumps each of 40 m3/hour capacity and 50 m. head (one as standby) capable of handling water upto 100 deg.C. The imbibition water shall be applied before the last mill through gunmetal chokeless type nozzles. These pumps shall be made of SS-409 body impeller and shaft.

Auto Imbibition control shall be provided to avoid excess application of water when crushing is lower. The system shall be suitable to control the imbibition water flow rate sensing the brix of last expressed juice.

(i)Bagasse Elevator and Conveyor

i) The bagasse belt conveyor

A belt conveyor is to be installed to receive the bagasse from last mill discharge chute and to carry it to bagasse elevator.

The length of the bagasse belt conveyor shall be10.0 meters and width 1200 mm. Its inclination shall be around 5º with horizontal and be driven by motor of 10 HP coupled to a suitable helical reduction gear box etc.

ii)Bagasse Elevator

One steel slat or rake type bagasse elevator of all steel construction of 1200 mm effective width and suitable length (inclination not to exceed 45 deg. with the horizontal) to carry about 30 tonnes of bagasse per hour and driven by TEFC electric motor of *25* BHP through helical speed reducer with open gearing to give a linear speed of 25 meters/minute shall be provided. It shall have two strands of chains of 150 mm pitch conforming to IS-8466. The breaking strength of chains shall be minimum 40,000 kgs.

The elevator chain shall be driven over two cast steel sprockets with machine cut teeth only mounted on 130 mm dia. mild steel head shaft running in 110 mm size gun metal bearings and secured in cast steel housings. The tail shaft shall have two cast steel sprockets having machine cut teeth mounted on 100 mm central dia. steel shaft running in 90 mm size gun metal bearings secured in cast steel housing. The head and tail shaft shall be of 40C8 quality. The bagasse scrapers would rise on the bottom side of the elevator and discharge by means of mild steel chute bolted to head columns into the bagasse carrier. The trough side and bottom plate shall be of 6 mm thick mild steel duly reinforced with 65mmx65mmx6mm angles.
Easy sliding screens shall be provided on the elevator for screening the bagacillo. The screening area shall be 8.0 m². Each screen shall have a blind portion for sliding it in the elevator portion for cleaning or changing the screens while working. Width of each screen shall not be more than 600 mm. The screen shall have punched conical holes having 6/8 mm dia. size on the surface facing the bagasse elevator. Platform and staircase shall be provided for approaching on both sides of the elevator. Bagasse elevator shall have tightening arrangement at tail end.

iii) Main Bagasse Carrier

One main bagasse carrier of double trough design and all steel construction of 1200 mm effective width and of suitable length to suit the boiler for ultimate capacity of 2500 TCD. It should be able to carry about 30 t/hr bagasse. It should be driven by 50 BHP TEFC, 1440 rpm AC electric motor through helical gear box with open gearing to give a linear speed of carrier not more than 30 m/min. Similer type of driving arrangement shall be provided on the other end of head shaft (as stand by).It shall have two strands of chain of 150 mm pitch and conform to IS-8466. The breaking strength of the chain shall be minimum 40,000 kgs.

The bagasse carrier shall have construction similar to bagasse elevator and shall have 6 mm thick side and bottom M.S. plate over the entire length of the carrier & to be supported on steel channel, columns, provided with rigid bore plate. The bottom of the trough should be reinforced & cross braced by 65x65x6 mm thick angles. The columns should be adequately braced. The conveyor shall be complete with all structure and feeding chutes to boiler etc. and will have arrangement to feed the bagasse to the boilers from return bagasse carrier. The individual chutes to each boiler should have slide operated rack and pinion type diagonally cut doors operable from the working platform of the boiler. Suitable tightening arrangement of the chain be provided. One

platform on one side of the carrier should be provided for attending the repair work. The length of the carrier should be suiting to install additional boiler for future expansion of 2500 TCD.

iv) Return Bagasse Carrier

One return type self discharge bagasse carrier of 1200 mm effective width similar in construction as elevator shall be provided. The horizontal feeding length of this carrier outside the boiler house building shall be minimum 12 meters. The conveyor shall be complete with all its structure and be driven by TEFC, electric motor of 40 HP.1440 rpm coupled to helical reduction gear box with open gearing to give a linear speed of the conveyor not more than 25 meters/minute. Similar type of driving arrangement shall be provided on the other end of head shaft (as stand by). Idler sprocket having machine cut teeth shall be provided wherever there is change in direction. A shed and approach from the ground shall be provided to attend the drive of the conveyor. Horizontal portion of this carrier shall not be more than 300 mm below ground level. M.S. guard should be provided over the horizontal portion of the return bagasse carrier to ensure safety of workman. It should have tightening arrangement.

Bagasse elevator, main carrier and RBC must be interlocked. The return bagasse shall be off set with the main bagasse carrier and it shall have arrangement to deliver the bagasse to main carrier as well as it can receive the bagasse from main bagasse carrier. A gangway with hand railing shall be provided alongwith whole length of the bagasse carrier with access staircase from ground at the drive and from the top of the boiler furnace & boiler platform.

The chain should be 150 mm pitch and breaking load not less than 40,000 kgs. As per IS:8466

Surplus bagasse / Biomass handling and back feeding to boiler system shall be provided by the seller. Suitable belt conveyor system to carry surplus bagasse to bagasse yard and back feeding shall be provided by the seller.

j) Mill House Crane and Gantry

One three motion electrically operated overhead mill house travelling crane conforming to class II IS specifications having one crab of 15.0 tonnes SWL capacity & with box type design and one HOT crab of 2 T SWL capacity with independent trolley complete with crane gantry shall be provided. The crane rail centre distance shall be of 22 meters and length of travel for Mill House Crane shall cover fibrizer to Bagasse elevator. The specifications for mill house crane shall be as under :

Height of lift	-	10 meters
Main hoist speed	-	2 meters/minute
Long travel speed	-	10 meters/minute
Cross travel speed	-	10 meters/minute
Main hoist motor	-	30 HP TEFC sq. cage, S4 duty.
Long travel motor	-	15 HP slip ring TEFC, S4 duty.
Cross travel motor	-	10 HP slip ring TEFC, S4 duty.
Span of LT wheel	-	22 Meter.

All the above motors shall be of crane duty.

The supplier will provide the loading data and span details to enable the purchaser to arrange suitable design columns to support the mill houses trusses and the crane gantry.

2. Boiling House Section (Juice Treatment)

(Span of boiling house building up to sugar house should not be less than 24 Meters and for gravity flow appropriate height of working platform from factory floor to be kept.)

2.1 Mass flow meter One No.

Screened juice from Rotary screen will be pumped through mass flow meter capable of measuring 30 – 150 cub. m/hr. of juice. The measured juice is pass through series of juice heaters to heat raw juice from 28 – 70 deg. C

Capacity of mass flow meter	:	150 tons/hr.
Type	:	Coriolis
Press drop across	:	1 bar
Accuracy	:	±0.10 % of mass flow rate.

Mass flow meter will include

(a) Mass flow sensor
(b) Mass flow transmitter
(c) Interface cables
(d) Centralized computer, system with CPU, color monitor, key board Printer etc.

The mass flow meter shall be provided with Jumbo display arrangement.

Install a suitable capacity check weighment tank for calibration of the juice without affecting the working performance of mass flow meter. The check weighment shall have arrangement for discharging the juice to the screened juice tank by gravity/pump.

Suitable arrangement for preparation, storage and pumping phosphoric acid shall be provided. The tanks shall be of SS 304, piping of PVC, two dosing pumps each of 0 – 40 l/min. with variable speed metering pump with head 20 m.

2.2 Juice heaters : 7 Nos.

Three Nos. vertical juice heaters of 120 m² HS each, one dynamic juice heater of 140 m² HS and one vapour line juice heater (VLJH) of 140 sq. m. HS shall be provided.

All vertical tubular juice heaters shall be multiple circulation type designed to have juice velocity of 1.8 m/sec. at 115% juice on cane at a crushing rate of 70 TCH.

The body shall be constructed from 10 mm thick, 25 mm tube plate and cover plates from 30 mm thick steel plate. The cover plates shall be provided with suitable stiffeners.

Raw juice 1st stage heating shall be done in VLJH located after last effect of quintuple set from 28 deg.C to 48 deg.C., second stage heating is done upto 70°C in the dynamic juice heater located between 3rd and 4th effect of quintuple set.

Sulphured juice heating shall be done in two conventional vertical tubular juice heater in series : 1st stage heating with 2nd effect vapour from 68 – 90 deg.C and the 2nd stage heating shall be done from 90 deg.C to 102 deg.C from 1st effect vapour. One juice heater remains as standby for sulphured juice heating.

Each vertical tubular juice heater shall be provided with easy opening device for cover plates. Two sets of double beat valve connections of having necessary inter

changeable connections of heating raw and sulphited juice heating, vapour bleeding connections with valves and top and bottom venting control by separate valve to atmosphere and vacuum arrangement and safety valve. The pipe line for vapour bleeding from 1st and 2nd effect of the vapour shall have separate headers (except dynamic and VLJH) and each sulphured juice heater can be operated on each header separately.

Two vertical dead end type 140 sq.m. HAS each shall be provided for heating clear juice with suitable vapour connection from 1st and 2nd effect of quintuple set. Juice inlet and outlet connections with by pass arrangement shall be provided. The 1st stage heating is done on 2nd effect vapour of quintuple set from 96 to 102 deg. C and 2nd heating is done on 1st effect vapour upto 112 deg. C.

Each vertical juice heater shall be provided with suitable condensate receiver along with a pump of 6 m^3/hr capacity of 30 m head and 1440 rpm.

The exhaust condensate shall be pumped to boiler feed water tank and vapour condensate to be pumped to hot water tank after flash vapour recovery.

Arrangement should be provided to drain of all juice heaters and drained juice to go to sulphured juice receiving tank. The platform to be provided below the juice heaters for opening the covers, draining and repairs etc. Each juice heater should have mercury filled 150 mm dial type thermometer, inlet and outlet branch of juice and for the steam chest.

The tubes of the heaters shall be annealed stainless steel tubes of S.S.-304 grade confirming to I.S.13316-92 of 45 mm outside dia and 18 gauge should be used. Ligament of the tubes shall be minimum 12 mm. The lengths of the tube shall be 4000 mm.

2.3 Juice sulphiter : One No.

The continuous juice sulphitation unit of 80 HL capacity designed for 70 t/hr juice, retention time not less than 7 min. and working height of juice column above the gas distribution not less than 2 m, stack gas recovery tower, one cylindrical receiving tank of 70 HL capacity. Two centrifugal pumps of 100 m^3 /hr. capacity with 60 m head (one standby) capable of pumping juice through two juice heaters in series to flash tank of the clarifier.

The continuous juice sulphitation unit shall be made from 12 mm thick mild steel plate and be completed with milk of lime proportioning arrangement, juice and So_2 gas pipe line etc. The addition of milk of lime in proportion to juice flow will be ensured by installing auto pH control system. Sulphur dioxide gas pipe line shall be C.I. cross and cast iron piping.

The tank shall be equipped with stirrer for proper mixing of mixed juice and MOL. The stirrer speed around 16 rpm.

a) Auto pH Control system : One No.

Auto pH control system will be installed for the juice liming tank to control the treated juice pH, which includes pH indicating and recording system for on line juice pH measurement with control milk of lime as per juice flow.

b) Instrument and Control unit

(i) pH electrode

(ii) pH indicator 10 mm height LED display for final pH at juice sulphiter in the control room.

(iii) Indication and recording and shall be measured at any given time with recording.

2.4 Sulphur furnace : Three Nos.

2.4.1 Two automatic sulphur burners of film type capable of burning 70 kg/hr each, of standard quality sulphur and suitable for producing sulphur dioxide at a concentration of 10 ± 2% V/V sulphur dioxide.

The sulphur burner comprises of the following installation.

- Molten sulphur dosing pump with AC VFD 2 Nos. for each sulphur burner (one working one standby).
- Feeding valve spindles and seat shall be of stainless steel.
- The melting chamber of sulphur shall be of 10 mm thick mild steel plate, and combustion chamber shall be 12 mm thick mild steel with refractory lined filled with the refractory bricks.
- Water jacketed counter current cooling arrangement for the vertical gas pipe, cast-iron scrubber etc. to cool the gas upto 70°C.
- All interconnected So_2 gas pipe lines upto header outlet with isolating valve so as to designed that both juice and syrup could be sulphited from any of the furnaces either singly or jointly.
- Sulphur pipe line shall be of cast-iron with CI cross pieces, conforming to IS: 210 – 1978.
- Plat form around So_2 gas piping.
- Complete automation.
- Heat recovery system shall be provided in order to avoid usage of medium pressure steam. (VAPCON)

2.4.2 One continues burner fully automatic mircoprocessed suitable for burning 30 kgs of standard quality sulphur per hr. for syrup sulphitation. All other specification as in case of 2.4.1.

2.5 Air compressor : Two Nos.

Two air compressor (One standby) capable of supplying 500 cub. m air at 1kg/cm^2 pressure for juice sulphitation and One air compressor capable of supplying 250 . m air at 1kg/cm^2 for syrup sulphitation. Each air compressor shall be provided with necessary pipe lines, gauges, valves etc. All furnaces shall be connected in such a way that any furnace could be worked with either compressor. The compressor shall be fitted with automatic air governor which can load and unload the compressor at pre-adjusted pressure. In addition hand unload shall be provided. The air compressors should be vertical type and with water cooling system.

2.6 Milk of Lime Preparation Station

a) Lime Slaker : One No.

Rotary type lime slaker capable of slaking about 500 kg burnt lime per hour shall be provided. A koran flash tank type lime classifier with grit remover hydro cyclone type classifier. Two milk of lime storage tanks of 12.5 cub. m. each cylindrical, vertical sloped bottom open top fitted with stirrer speed 30 rpm and two centrifugal pumps (one standby), rubber lined, each capable of delivering 3 cub. m/h milk of lime at 20 m head and two grit catchers common for both the pumps.

The slaker shall be continuous type made of 6 mm shell plate and end plate 8 mm thick shall be driven by electric motor through reduction gear box to give 6 to 8 rpm.

b) Vibratory screen for milk of lime (MOL) : Two Nos.

Vibratory screen will be provided after lime classifier to separate fine grit from milk of lime. The capacity of screen will be suitable to handle 1.5 m^3/hr milk of lime (MOL) fitted with SS 304, 60 mesh. One working and one as standby.

c) Lime Proportionate Unit : One No.

The Lime proportioning unit, cyclone type shall be provided to control MOL flow rate to the sulphitation tank according to set point. MOL continuously circulating from lime proportioning unit to juice liming tank and excess lime is recirculated to MOL storage tanks.

2.7 Clarifier and filtration

a) Clarifier : One No.

7315 mm dia. Clarifier with four compartments, each compartment to have height of 1524 mm with a total holding capacity of 237 cub. m. The clarifier shall be four compartments with separate juice inlet and separate mud outlet from each compartment. There should be two juice withdrawal points preferably diametrically opposite in each compartment to minimize turbulence.
The flocculent compartment complete with skimmer and feed well shall be installed separately.

The classifier shall be made of carbon steel having following minimum thickness.

Sl. No.	Particulars	Thickness in mm
1.	Bottom plate	12
2.	Shell plate	10
3.	Tray plate (Inter mediate)	12
4.	Tray plate (TOP)	10
5.	Top cover	10
6.	Flocculating compartment	10

The juice withdrawal should be through take off pipe of semi circular shape located inside each compartment of clarifier.

The continuous clarifier shall be complete mild steel flash tank; clear juice and mud withdrawal gravity boxes with sleeves; telescope pipes, and 'O' rings hinge type squeezers; driving mechanism with variable speed drive with motor, consisting of sprocket; chain and drive guards, all inside and outside clear juice piping, all inside and outside mud piping, all valves and pipe fittings etc. and complete with peripheral walkway, angle iron bracket supporting angles, piping for railing, rail support etc. Four man holes one for each compartment each manhole to have platform, railing, access ladder, sump tank with support, insulation material, special electrodes required for site

welding etc. After installation, the clarifier compartments shall not have any wrapage. All the pipe connections on to the clarifier shall be connected with minimum 12 mm pads, mud liquidating pump of 25 m^3 / hr and 20 m head of CI construction with stainless steel fittings complete with drive motor to be provided.

Two clear juice centrifugal pumps each of 100 m^3 / hr at 30 m head and CI construction with stainless steel fittings complete with drive motor and suitable column having sight and light glasses to be provided for pumping juice through direct contact juice heaters to 1st body of quintuple effect evaporator. Provision of recirculation of juice in the clarifier to be also provided.

The clarifier shall be supported on a concrete structure.

b) Vacuum Filter

Rotary cane mud vacuum filter shall be 3.05 m dia x 6.10 m long with filtration area 58 sq.m. shall be installed at a height suitable to operate from the platform level + 8.0 m from factory floor level.

The unit shall consists of a drum, drum head internal, piping shall be of AISI 304 grade P P decking.

Filtering Area	:	58 sq. m.
Size	:	3.05 m dia x 6.10 long
Drum thickness	:	5 mm AISI 304 grade
Drum head	:	8 mm AISI 304 grade

The screen shall be of AISI S1 304 grade with 100 holes sq. cm with 0.5 mm dia meter holes. Screen fixing should be zig – zag chulking strips only. The ovality of the drum shall not be more than 3 mm.

The trunion shall be of gun metal with suitable lubricated bearings. Bearing materials of construction shall be either poly propolene or gun metal.

The filter cake wash system shall consists of spray pipes with sufficient nozzles and drip trays for efficient cake washing. A water strainer shall also be supplied with the provision for steam washing.

The drum shall be driven by 2 KW TEFC squirrel cage motor with arrangement for varying the speed between 12 rph and 36 rph.

The trough shall be MS construction with 10 mm thick plate fitted with constant speed agitator driven by 1 KW TEFC squirrel cage motor. The trough shall be fitted with suitable over flow connection and quick operating drain valve.

The filter shall be equipped with centralized multipoint lubrication system for lubricating drum bearings, swivel unit bearings valve heads. The filter should preferably be connected to trunion with linkage for driving the multi point pressure lubricator.

The clear and muddy filtrates withdrawal system shall be from both sides of the drum with isolating globe valves comprising of bronze valve body, bronze wear plates and stainless steel plate.

The vacuum regulation for light and heavy side shall be through on automatic control valve consisting of bronze valve body bronze wear plates and stainless steel pipe plate.

The internal piping shall be of stainless steel construction. The individual deck piping shall be connected to a receiving pot and outlet will be taken from the pot and to be connected to the trunion.

Individual piping for clear and mud filtrates, drum both sides of filter shall be of stainless steel and extended upto the respective filtrate receivers. Necessary flexible hose pipes shall be provided in the filtrate piping.

The filtrate cake shall be discharged directly on the filter cake conveyer belt. (One mud Belt Conveyor for conveying press mud from discharge end of first belt conveyor to Bio Compost Plant may be offered separately of 100 mtr. Length complete with structure, one side platform, shuts and drive unit.)

The vacuum filter shall be complete with pressure gauges at water inlet, vacuum gauges at the valve heads. The gauges shall be of 150 mm dia. dial size.

The vacuum filter shall be complete with two numbers filtrate receivers fitted with gun metal, vacuum release assemblies and copper floats, one number vacuum regulating valve, two numbers filtrate pumps each capable of extraction 15 m^3 / hr filtrate under vacuum 500 mm mercury and discharging at 20 m head, one cascade condenser, one entrainment separator with sealing arrangement to discharge entrained juice to mud receiving tank; feed mixer, one vacuum pump of 12 cum. m/min capacity against 500 mm mercury complete with motor and drive etc. One overflow tank of 40 HL capacity with steam coil and trap, one centrifugal blower of 270 cub. m/h capacity; one bagasse cyclone suitable for separating bagacillo with mild steel shell adjusting fin, two way valves fitted with manually operated flap door, one feed mixer, two mud recirculation non clog centrifugal pump of 20 m^3 / hr capacity at 20 m discharge head complete with motor and motor drive. The cake wash water pump of 10 cub. m/h capacity at 30 m discharge head complete with motor, drive etc. The bagacillo blower shall be complete with 400 mm dia. blowing pipe from mill house to bagacillo cyclone along with pipe fittings etc. One belt conveyor for in line installation of vacuum filter of 450 mm width and suitable length for discharging mud at least 8 m outside the filter house complete with motor drive shall be provided.

2.8 Evaporation Station

It is proposed to follow quintuple effect evaporator and heating surface area of evaporator bodies designed according according to bleeding scheme as under :-

i) Raw juice first heating in VLJH - with last body vapours
ii) Raw juice 2nd heating - with IVth effect vapours
iii) Sulphited juice 1st heating – with 2nd effect vapours
iv) Sulphited juice 2nd heating – with 1st effect vapours
v) Clear juice 1st heating – with 2nd effect vapours
vi) Clear juice 2nd heating – with 1st effect vapours
vii) Boiling of 'A' massecuite – with 2nd effect vapours
viii) Boiling of 'B' massecuite – with 2nd effect vapours
ix Boiling of 'C' massecuite – with 1st effect vapours

a) The following are the heating surface area

1st effect : 1200 sq. m. Heating Surface (HS) tube 4000 mm long x 45 mm O.D. x 18 SWG wall.

Moc : S.S.-304 grade confirming to I.S.-13316-92.

2nd effect : 1100 sq. m. Heating Surface (HS) tube 2000 mm long x 45 mm O.D. x 18 SWG wall.

Moc : S.S.-304 grade confirming to I.S.-13316-92.

3rd effect	:	450 sq.m. Heating Surface (HS) tube 2000 mm long x 45 mm O.D. x 185 WG wall.
Moc	:	S.S.-304 grade confirming to I.S.-13316-92.
4th effect	:	450 sq. m. Heating Surface (HS) tube 2000 mm long x 45 mm O.D. x 18 SWG wall.
Moc	:	S.S.-304 grade confirming to I.S.-13316-92.
5th effect	:	300 sq. m. Heating Surface (HS) tube 2000 mm long x 45 mm O.D. x 18 SWG wall.
Moc	:	S.S.-304 grade confirming to I.S.-13316-92.

Ligament of the tube holes shall not be less than 12 mm.

The first effect of quintuple set receive exhaust at 120 kpa (g)

First effect long tube rising film type vessel (Semi kestner) of mild steel welded construction will be in two parts, i.e. a calandria and a catch all installed one beside other. The catch all will have chevron type separator,

To ensure, the vapour pressure of 1st body of quintuple effect evaporator does not exceed 40 kpa (g) provide suitable relief valve spring loaded or dead weight lever type. The 2nd and 3rd bodies shall have a vapour space height (between top tube plate and the bottom of the umbrella or cylindrical portion of the vapor space) not less than 2.5 times the calandria height and 4th and 5th body shall have vapour space height not less than 3 times the calandria height.

For bodies having heating surface upto and including 600 sq.m. minimum thickness of mild steel plate for calandria **of 16mm** and body shall be 12 mm, bottom saucer 16 mm and tube plate 25 mm and for body above 600 sq. m. minimum thickness of mild steel plate of calandria and body shall be of 16 mm, bottom saucer 22 mm and tube plate 32 mm. The bottom saucer shall be welded to the calandria. The domes of the bodies shall have outward flow centrifugal save all of suitable design. A suitable external save all fitting in the vapour pipe after last body giving to the condenser shall be provided. Each body shall have three sight and one light glasses, lowest sight glass shall not be higher than 1.5 m from the working platform and 250 mm from top tube plate.

The placement of tubes shall provide effective steam distribution arrangement.

The evaporator set shall be complete in every respect with fittings for satisfactory operation with 8 mm thick mild steel interconnecting pipes. The rubber seated right angle valves shall be used for vapour pipe lines and S.S. 304 seated valves shall be used for exhaust.

Syrup extraction system with suitable columns connected to two syrup extraction pumps (one standby) of 30 m^3 / hr capacity at 30 m head through SS screen grit catchers shall be provided.

Continuous syrup sampler and sampling arrangement from each body shall also be provided.

Suitable individual condensate extraction pump with suitable size receiver bottles to be provided to all bodies. The rpm of the motor of the condensate extraction pumps should

not be more than 1450, condensate outlet pipes from various units to have sight glasses at eye level in addition to sight glasses in extracting columns.

Test cocks should also be provided at all units individually for testing condensate water for sugar traces.

All the condensate pumps delivery lines should have suitable size connection with valve to test and to let out the water in the drain as and when sugar traces are found in the condensate. All interconnecting vapour, juice, hot and cold water and exhaust piping should be designed for the capacity. Suitable condensate flash recovery system shall be provided.
A working platform with staircases from ground level under the bodies for cleaning, repairs and maintenance shall be provided.

Exhaust steam connections shall be such that all the exhaust is fed to the 1st body of evaporator and an exhaust steam connection through an isolating valve of 500 mm dia **S.S. 304 valve sheet** shall be provided in vapour line for using exhaust during non-working of evaporator set.

For open soda boiling before starting, cleaning, live steam entry and vapour out let to atmosphere at top shall be provided in each body.

Space to be provided in the layout for installation of one more body in future for expansion to 2500 TCD capacity.

b) Caustic Soda Tank and Pump : One unit

Suitable arrangement for preparation of caustic soda solution and pumping the same to the evaporator bodies to be provided. Recirculation arrangement also to be provided. Capacity of the tank shall be 120 HL, pump capacity shall be 23 l/s against a head of 15 meters.

c) Flash vapour recovery system

Install two closed cylindrical receivers installed at 3.5 m level on concrete staging. The capacity of exhaust condensate receiver shall be 50 HL and that of vapour condensate receiver 125 HL. These tanks shall be provided with level indicator outside the tank and necessary vapour vent piping. The exhaust flash vapour shall be connected to 2nd effect of quintuple effect and vapour vent piping is to be connected to main vapour line. The condensate piping shall be such that the condensate from 2nd to 5th effect of quintuple and A, B pans could go vapour condensate receiver. The condensate pipe in these receivers shall lead upto 1/4 height from the bottom of the receiver for sealing purpose. The pumps (one common standby) each of 30 m^3 /hr capacity and one pump of 15 m^3 /hr capacity against head of 30 m shall be provided for pumping condensate from these tanks to hot water tank/boiler feed water tank respectively.

Plate thickness : 16 mm with stiffeners

2.9 Syrup sulphitation unit

One continuous syrup sulphitation unit of 30 HL working capacity capable to process syrup of 65° Bx. with working height of 1.5 m of syrup above the gas distribution, stack gas recovery tower made of 10 mm thick mild steel plate, complete with So_2 absorption arrangement and all necessary pipe lines, valves etc. shall be provided. Two syrup pumps of 30 m^3 /hr capacity at 30 M head with electric drive (one stand by) grit catchers and one sulphited receiver of 450 mm dia and 1800 mm height with sight and light glasses, inlet and outlet and equalizing connections shall be provided.

2.10 Graining and Crystallization Plant

a) Syrup and Molasses Storage Tanks

Provide, 10 tanks of 150 H L each, capacity to store syrup, molasses and melt etc. at the pan floor. The height of the tanks above the pan floor shall not be more than 1.2 m. These tanks shall be preferably cylindrical. Each tank shall be provided level indicating devices with SS – 304 floating valve.

Two or three tanks to be arranged in one nest depending upon the material to be stored with the provision of separate nest for syrup, each molasses and melt. Each melt shall be interconnected at the top. The tanks shall be made of 8 mm mild steel plate. Molasses storage tanks shall be provided with steam heating coils with necessary valves and non return valves, draining arrangement, pipes, gutters, valve etc. The wash out connection of each tank to be connected by a pipe to the sulphited juice receiving tank with suitable valve.

Three pipe lines of 100 mm dia with right angle valves from the tanks to the pans i.e. one for syrup, melt, AL molasses etc. Second for A – heavy molasses and C- light and third for low grade molasses to be provided.

b) Molasses Conditioners

Three molasses conditioners shall be provided, one each for A – heavy molasses, B – heavy molasses and C – light molasses, to dissolve sugar crystals in respective molasses. Each molasses conditioners shall be vertical, cylindrical and provide with stirrer and automation to control brix and temperature. Brix from outlet molasses conditioner will be about 70° and temperature will be about 70°C by controlling water and steam respectively. These molasses conditioners will be located near to their respective pans i.e. A, B and C pans.

A-Heavy molasses conditioner: One molasses conditioner, capacity 3.0 m^3 will be provided for conditioning A –Heavy molasses.

B-Heavy molasses conditioner : One molasses conditioner, capacity 3.0 m^3 will be provided for conditioning B – Heavy molasses.

C-Light molasses conditioner : One molasses conditioner, capacity 1.5 m^3 will be provided for conditioning C – light molasses.

2.11 Vacuum Pans : 5 Nos.

Five batch pans shall be provided for boiling A, B & C-massecuite and preparing B and C- grains for B and C massecuite boiling. Each pan shall be of central down take calandria type with mild steel welded construction.

Capacity	:	40 t
Heating surface Area/ Strike volume ratio	:	6.6 m^2 / m^3
Graining volume/Strike Volume	:	35 – 37%
Down tube diameter / Top tube plate diameter	:	40% maximum
Strike level above top tube plate	:	1400 mm (max)
Tube material	:	SS 304 confirming to I S 13316 – 92
Out side diameter	:	101.6
Thickness	:	16 SWG
Length	:	900 mm

Ligament of tube holes : 16 mm (min.)

Each pan shall be provided double tangential vapour entry in the calandria W shape bottom saucer shall be welded to the calandria. A suitable arrangement for expansion of tubes in the bottom tube plate shall be provided. Bottom saucer shall be of ring supported design of minimum 750 mm height. Thickness of various parts of pan shall be as follows

Tube plate	:	25 mm
Calandria shell	:	12 mm
Vapour belt	:	12 mm
Save all	:	10 mm
Save all internals	:	8 mm
Top cone	:	12 mm
Vapour pipe	:	8 mm
Bottom saucer	:	16 mm

These pans shall be fitted with a centrifugal type save all designed to have a maximum vapour velocity 45 m/s at maximum evaporation rate.

Each pan shall be provided with following fitting, valves and gauges.

S.No.	Fittings	Size (mm)	Quantity
a.	Sight and light glasses	200	04 Nos.
b.	Gun metal proof stick	-	01 No.
c.	Stainless steel basin	400	01 No.
d.	Man holes with hinged type closing doors (one fitted in the vapour belt, one in bottom cone.	500	02 Nos.
e.	SS water metering cum recorder	100	01 No.

Each unit shall be complete with the matching flanges for the following connections and accessories. All flanges shall conform to BS – 10 Table - D

S.No.	Connection and accessories	Size (mm)	Quantity
a.	Condensate outlet	100 mm	2 Nos.
b.	Main feed inlet	100 mm	1 No.
c.	Syrup / molasses inlet on feed box	100 mm	3 Nos.
d.	Non-condensable gas	50 mm	4 Nos.
e.	Cold water (body & calandria)	100 mm	2 Nos.
f.	Wash out	100 mm	1 No.
g.	Cut over connection	200 mm	1 No.
h.	Exhaust/vapour inlet	500 mm	1 No.
I	Washing connection vacuum breaking connection	100 mm	1 No.
j.	Hot water inlet on feed box	50 mm	1 No.
K	Movement water inlet on feed box	25 mm	1 No.
l.	Hot water inlet for sight glass	25 mm	1 No.
m.	Steam inlet on feed box	100 mm	1 No.
n.	Air vent	100 mm	1 No.

o.	Vapour outlet	900 mm	1 No.
p.	Safety valve	100 mm	1 No.
q.	Catch valve washing	100 mm	1 No.

Massecuite discharge valve : 1 No.

Pneumatically/ Hydraulic operated massecuite discharge valves of suitable size shall be provided for each pan. The valve shall be operated through a control box installed at pan floor.

S.No.	Gauges	Size (mm)	Quantity
a	Dial type pressure gauge for calandria, Range 0 – 1 kg/cm² (g)	150 mm	1 No.
b	Dial type pressure gauge for vapour belt, Range 0-1 kg/cm² (a)	150 mm	1 No.
c	Dial type temperature gauge one each for calandria and vapour belt, Range 0 – 150 deg.C	150 mm	2 No.

Each pan shall be provided with one syrup / molasses feed box 150 mm NB connecting the outlet pipe line of storage tanks and the pan.

Hot water cum recorder capable of measuring 15m^3 / Hr. shall be provided. Pano meter with automatic feed control with centralized computerized all boiling parameters system shall be included in supply scope.

The fittings shall be generally specified but all fittings are necessary for the easy and efficient operation of the pan station shall be included whether or not specified.

Space to be provided in the layout for installing one more pan in future for expansion to 2500 TCD capacity.

2.12 Seed & Vacuum Crystallizers : 4 units

One seed crystallize open type of 30 tons net working capacity and three vacuum crystallizers of 30 tons capacity for A, B and C graining.

One seed crystallizer of 30 tons net working capacity and three vacuum crystallizers of capacity as mentioned above, net working capacity upto the sight glass, centre of which shall be 200 mm below the top. All crystallizers shall be fitted with stirrer coupled with suitable HP TEFC motor through planetary gear unit and necessary fittings. The speed of the stirrer shall be of 60 rph. Necessary inter connecting pipe lines between these crystallizers and pans shall be provided.

The shell of the crystallizers shall be made of minimum 8 mm thick MS plate with necessary stiffeners and end plate minimum 16 mm thick MS plate with stiffeners.

Vacuum crystallizers shall have four sight glasses on the side and one sight glass with light and reflector at top. One man hole of 500 mm dia. and arrangement for sight glass washing are to be provided. A ladder to be provided on each seed and vacuum crystallizer. Cutover valves of these crystallizers should be operable from pan floor through worm wheel.

2.13 Receiving and cooling crystallizers : 8 Nos.

i) Two Nos. 'U' shape open top horizontal batch type air cooled crystallisers each of 45 tons for A-massecuite.

ii) Three Nos. 'U' shape open top horizontal batch type water cooled crystallizers each of 45 tons capacity for B-massecuite.

iii) Two Nos. horizontal 'U' shape open top batch type air cooled crystallizers each of 45 tons capacity as strike receivers for C-massecuite.

iv) One No. mono vertical crystallizers of 150 tons capacity.

a) A-Crystallizers : 2 units

Horizontal 'U' shape open top receiving crystallizers will be provided for receiving massecuite from A-massecuite pan. Each crystallizer shall be mild steel construction and fitted with stirrer. These crystallizers shall be located at 8.5 m above FFL.

Capacity : 45 tons
Stirrer speed : 1 rpm
Stirrer drive : 5 HP AC VVVF drive through planetary gear

b) B-crystallizer : 3 units

Capacity : 45 tons each.
Stirrer speed : 0.5 rpm
Stirrer drive : 5 HP AC VVVF drive through planetary gear

Horizontal 'U' shape open top, receiving and cooling crystallizers will be of mild steel construction fitted with coils and stirrer. Necessary cooling surface to be provided, to cool the massecuite.

For cooling surface (m^2) to volume (m^3) shall be minimum 1.8 for B-massecuite and for C-massecuite cooling surface (m^2) to volume (m^3) shall be minimum 2.0. The heat exchange elements shall be tested at pressure of 6 kg/cm2 (g). The heat exchange element for water cooled crystallizers should be of boiler quality.

The shell of horizontal crystallizers shall be made of minimum 10 mm thick mild steel plate and end plates 16 mm thick.

Receiving crystallizers shall be at least 2.5 m lower from the discharge valve of pans so as to provide suitable gradient for flow of massecuite.

A & B massecuites flow to their respective pug mill by gravity.

c) C-crystallizer : 2 units

Horizontal 'U' shape open top receiving crystallizers will be provided for receiving massecuite from C-massecuite pan. Each crystallizer shall be mild steel construction and fitted with stirrer. These crystallizers shall be located at 8.5 m above FFL.

Capacity : 45 tons
Stirrer speed : 0.5 rpm
Stirrer drive : 5 HP AC VVVF drive through planetary gear

d) Mono-vertical crystallizer for C massecuite : 1 unit

Mono vertical crystallizer, having 150 ton capacity cylindrical vessel will be provided for cooling of C-massecuite from 65 deg. C to 45 deg. C. The vertical crystallizer will be of mild steel construction fitted with stationery coils and stirrer.

Massecuite flows downward in the vessel and upward through raiser pipe and feed to the pug mill of C-centrifugal machine by gravity. Suitable rating motor drive with planetary type gear box shall be provided.

Mono vertical crystallizer shall conform the following specification:

Plate thickness

Bottom	:	12 mm
Shell middle Portion	:	12 mm
Shell top portion	:	10 mm

Following fittings shall include

- Temperature gauges for massecuite inlet and massecuite outlet, cold water inlet and outlet, hot water inlet and outlet, capillary type 150 mm dia, dial and range 0 – 100 deg. C.

- Sufficient Nos. of man holes, 500 mm size for easy maintenance Valves and cocks as necessary for by passing coils in case of leakage. Two massecuite pumps (one standby) each of 7.5 tons per hour capacity and 30 m head complete with necessary pipe line, valves etc. for pumping C-massecuite to mono vertical crystallizer, steaming arrangement shall be provided to these pumps. One liquidation pump of similar capacity shall be provided, C-massecuite will be transferred from mono vertical crystallizer to centrifugal pug mill by gravity.

- A closed circuit of cold and hot water recirculation system shall be provided for C-massecuite cooling. The system comprise of cold and hot water receiving tanks, cold water pumps, hot water pumps and one cooling tower to cool the recirculated water from vertical crystallizer. Condensed water will be used as make up water.

2.14 Condensing Station : 6 units

Six co-current single water entry condenser shall be provided, one for evaporator and one each for pan condenser to condense vapour.

Each condenser shall be of stainless steel construction with multi spray and jet nozzles and having following duty conditions.

Type	Single water entry co-current multi jet, spray type
Evaporator	Suitable for 600 mm dia. Vapor pipe.
Pans	Suitable for 900 mm dia vapour pipe
Vapor condensing	As per design.
Capacity	

Pressure in condenser	110 mm Hg. Absolute
Inlet water temp.	32 deg.C
Approach Temp.	10 deg. C

Material Plate thickness

Shell	5 mm AISI 304
Bottom cone	5 mm AISI 304
Internals	As per design
Tailpipe	3 mm AISI 304

Each condenser shall be provided with necessary fittings such as water inlet connection, water outlet connection and vapour inlet connection. One leak proof butterfly valve shall be provided for the water inlet connection. A water strainer shall be provided between the valve and condenser water inlet.

All nuts, washers etc. of the condenser shall be SS – 304 quality material.

Tail pipe shall be provided with stainless steel piping of 3 mm thick. A flange joint in the tail pipe shall be provided below the support and above water level of tail water pipe for introducing dummy during water testing.

The tail pipe shall be provided with capillary type temperature gauges, suitably to read the temperature from condenser plat form.

2.15 Injection & spray water pump and spray pond piping : 1 set

a) Injection pumps : 3 units

Injection Pump for Evaporator

One injection pump capable of delivery 300m3/hr. water against head 22 mtr. When condenser are placed at 10.5 mtrs. Level. The pumps shall have S.S. body, S.S. impeller with sq. case TEFC motor. The pump to be split casing design (UP type) the header shall be connected to common header of 500 mm dia with isolating valve.

Injection pump for pans

Three injection water pumps capable of delivering 900 m^3/hr. water against head of 22 m when condensers are placed at 10.5 m level. Two working and one standby.

The above pumps shall be of centrifugal type, Stainless Steel impeller and fittings and shall be complete with coupling, motor, starter, motor guard and foundation bolts etc. the pump directly couple SPDP slip ring Induction motor with suitable starter for continuous working. Priming pumps for injection and spray pump shall be provided. The starting current shall not exceed 300 percent of full load current.

The injection water pipe connection to condensers should have valve for regulation purposes. A pressure gauge in water line is to be provided. A common header of 500 mm dia. & 10 mm thick size shall be provided. Each pump shall have isolating and NRV in delivery line and 2 Nos. drain connection of 100 mm dia with blind be provided.

b) Spray pond and Pumps

The most economical cooling system shall be provided. Two pumps of 900 m^3/hr at 12 m head shall be provided (both are working). Suction line shall be of stainless steel. A common header made of 10 mm thick M.S., gradually reducing shall be provided. Spraying system shall consist of 125 spray nozzles, 5 nozzles, forming a cluster at a distance of 5 m. All the nozzles, branches, pipelines and fittings shall be of thermo engineering plastic with SS inserts. Fasteners shall be SS. The nozzles shall have SS inserts.

The cooling system for the water designed to enable to get atleast 10 deg°C between inlet and outlet water temperature.

2.16 Centrifugal Station

a) A -massecuite centrifugal pug mill : 1 unit

One pug mill shall be of 'U' shape, open top, carbon steel welded construction suitable for accommodating three machines of 1250 kg/charge. The pug mill fitted with a paddle type stirrer gear, shaft and couplings, suitable bearings shaft seals and all necessary fitting and mountings. The pug mill shall be driven by a totally enclosed electric motor through planetary gear reducer.

Net capacity of pug mill	:	7.5 m^3, Suitable to feed 3 # 1250 kg/charge Machines
Plate thickness		
Shell	:	6 mm
End plate	:	8 mm

b) A Centrifugal machines : 2 Nos.

Flat bottom fully automatic PLC/ DCS System based, recycling, batch type centrifugal machines shall be provided for curing A-massecuite.

Capacity	:	1250 kg/charge
No. of cycles/hr	:	20 (minimum)
Drive	:	AC VFD
Basket speed range (adjustable)		
Spinning	:	1250 rpm
Charging	:	150 – 230 rpm
Ploughing	:	40 - 60 rpm

Basic construction specifications are as under :

i) **Basket** :-Fully perforated welded construction with shrunk fitted hoop (reinforcing) rings. The spider hub shall have adequate sugar discharge area and is bolted to the basket.

Shell material : Stainless steel, 316 L

ii) **Screen** :-Triplex lining system comprising of backing screen, intermediate and front working screen.

iii) **Shaft** :- Shaft shall be made of high tensile strength forged alloy steel and designed for dynamic stability. The lower end of the basket is bolted to the basket hub and suspended from the bearing housing.

iv) Suspension on assembly:-Suspension assembly consists of coupling, suspension bowl, suspension bracket, suspension seat, buffers, bearings, brake assembly etc.

Oscillation sensor to be provided, designed to apply the brakes if basket gyrations exceed preset limit.

Bearing shall be of grease lubricated.

v) **Monitor Casing:** - Carbon steel fabricated construction with removable top to facilitate spindle and basket maintenance. Flanged inspection and cleaning cover on front facing shall be provided. Curb washing shall be provided. All the mountings such as discharger, bottom opening valve cylinder, charge regulator etc. are mounted on the top cover.

vi) **Discharge chute :-**Discharge chute at the bottom of monitor casing shall be provided for directing the sugar on the sugar hopper conveyor.

vii) **Plough / discharger :-**Plough / Discharger shall be fully automatic pneumatic, sequential operated, consisting of vertical guide shaft with strong shoe having replaceable tips. Plough cleans, screen thoroughly without touching and wearing it. Necessary interlock shall be provided to operate the discharger only at the specified lower speed.

viii) **Sugar discharge valve :-** Sugar discharge valve shall open during discharging of sugar and keeps closed tight during the rest of the operation. Actuator for the bottom discharge valve should be attached to the drive head. Actuating cylinder shall be Hydraulic / pneumatic.

ix) **Massecuite feeding system :-** Butterfly valve system shall be provided for massecuite feeding from pug mill to machines. The valve shall be leak proof and operatead pneumatically.

x) Charge regulator: - A massecuite charge regulator of suitable design shall be provided.

xi) Water washing system: - A suitable water washing system shall be provided for screen washing, sugar washing, curb washing in monitory casing and drip tray washing.

xii) Molasses separator: - An automatic molasses separator shall be provided with each machine for separation of A-Heavy, and A – light to delivered to separate gutters.

xiii) Solenoid valve: - A set of valves, pneumatic cylinders and limit switches as necessary for the automatic function of centrifugal machine shall be provided. Necessary air water piping for the above system also included in the supply.

xiv) Drive motor :- The drive motor shall consists of a totally enclosed fan cooled electric motor, squirrel cage, vertical mounted, suitable for operation on 400 V, 50 HZ, 3 phase supply. The motor shall be with IP 55 protection, class F insulation and temperature restricted to class B.

xv) Variable frequency controller: - The variable frequency controller for speed control system shall be provided for adjusting speeds at the desired level as specified for each function.

The system designed with electrically regenerative braking during the retarding cycle.

The variable frequency controller shall be provided in a dust and vermin proof vertical free standing panel with IP 44 protection with forced ventilation.

xvi) Incoming panel: - All incoming panels consists of an ACB, ammeter, voltmeter with fuse and selector switch and ON indication and shall be designed for symmetrical fault level of 35 KA (rms) of one second.

xvii) Control Panel: - The control panel shall be self supporting floor mounting type and make of sheet steel reinforced with angle iron frame with single front door and pick off covers on back side. Control box shall have speed and supply indicator etc. Necessary arrangement in the panel shall be provided for tripping of the machine in case of high temperature as sensing through ETD's of the motors.

Suitable air conditioning system for VVVF controllers, Incoming/ outgoing panel shall be provided by the seller. The room civil work shall be provided by the purchaser.

xviii) AH Molasses receiving tank : One no.

One vertical, rectangular tank shall be provided to receive AH molasses from A centrifugal machines constructed with mild steel, with drain connection with valve.

Capacity : 1 m3
Thickness : 6 mm

xix) A H molasses pump : Two nos.

Two A H molasses pumps shall be provided to pump A H molasses to pan supply tank with all necessary pipe lines, NRV, steam connection etc.

Type : Rotary
Capacity : 12 t/h
Head : 30 m

xx) AL – Molasses receiving tank : 1 No.

One vertical, cylindrical tank shall be provided to receive AL molasses from A-centrifugal machines and shall be constructed with mild steel and a drain connection with valve.

Capacity : 1 m^3
Plate thickness : 6 mm

xxi) AL – Molasses Pumps : 2 Nos.

Two AL– molasses pumps shall be provided to pump AL molasses to pan storage tank with all necessary pipe lines, valves, NRV, steam connection etc.

Type : Rotary
Capacity : 6 m^3/h
Head : 30 m

xxii) Superheated wash water pumps : Two nos.

Two superheated wash water pumps centrifugal type shall be provided to pump wash water to batch type centrifugal machines through direct contact heater (DCH) one working and one standby. The capacity of wash water pumps shall be suitable to pump wash water to 2 # 1250 kg/charge centrifugal machines.

xxiii) Superheated wash water heater : One no.

One direct contact heater (DCH) of suitable capacity shall be provided to heat wash water from 95 to 120 deg. C by using exhaust steam of about 1.2 kg/cm^2(g) wash water shall be the pumped from wash water receiving tank to centrifugal station through wash water heater and return line from centrifugal machine shall be connected to wash water receiving tank.

xxiv) Air compressor for batch centrifugal machine : Two Nos.

Two air compressor shall be provided to supply oil and moisture free air for the pneumatic control of various operations of A-centrifugal machines. The unit shall complete with air drier, air receiver etc. one working and one standby.

Capacity	:	Suitable for 2 machines of 1250 kg/charge
Type	:	Reciprocating
Delivery pressure	:	7 kg/ cm^2(g)

c) B centrifugal machine

i) B massecuite and C after worker pug mill : 1 No.

The pug mills shall be U shape, open top carbon steel welded construction suitable for accommodating three centrifugal machines of 1100 mm diameter. The pug mill shall be fitted with a paddle type stirrer, couplings suitable bearings, shaft seals and necessary fittings and mountings. The pug mill shall be driven by AC motor through planetary gear directly coupled to shaft. Provide partition plat to separate B massecuite and CFW magma.

Net capacity of pug mill	:	5 m^3,Suitable to feed 3 # 1100 basket diameter of continuous machine
Plate thickness		
Shell	:	6 mm
End plate	:	8 mm

ii) B centrifugal machines : 1 No.

B continuous centrifugal machine shall be of vertical basket, under driven type with 0.09 mm screen size. The centrifugal machines shall be complete with all accessories.

Type	:	Vertical basket under driven (with 0.09 mm screen)
Capacity	:	12 T/hr
Gravity factor	:	2000

iii) B magma and C magma mixer:-

The B magma and C after worker magma mixer shall be provided for magmatising B sugar and C after worker sugar received from continuous machines. The magma mixer shall be horizontal. U shape open top mild steel construction. Suitable for three machines. The magma mixer shall be provided with double paddle type stirrer driven by AC motor through planetary gear directly coupled to shaft.

Capacity	:	5 m^3, Suitable for three continuous Centrifugal machine
Stiffer speed	:	16 rpm
Plate thickness	:	
Shell	:	6 mm
End plate	:	8 mm

iv) Magma pumps : 3 Nos.

Three B magma and CAW magma pump shall be provided to pump B magma and C magma from the magma mixer to melter / pan floor with by-pass arrangement and valves. Two working suitable for B magma and CAW magma and one common standby.

Type	:	Rota
Capacity	:	8 m^3
Head	:	30 m

v) BH molasses receiving tank : 1 No.

One vertical, rectangular tank shall be provided to receive B heavy molasses from B-centrifugal machines.

Capacity	:	1.0 m^3
Plate thickness	:	6 mm

vi) BH molasses pumps : 2 Nos.

Two BH molasses pumps shall be provided to pump BH molasses from BH molasses receiving tank to BH molasses storage tank located at pan floor (one working and one standby).

vii) CAW centrifugal machines : 1 No.

Continuous centrifugal machines shall be vertical basket under driven type, with 0.09 mm screen size. The centrifugal machines shall be complete with all accessories.

Dia of basket	:	1100 mm
Type	:	Vertical basket under driven
Capacity	:	12 T/hr (with 0.09 mm screen)
Gravity factor	:	2000

viii) CL molasses receiving tank : 1 No.

One vertical, rectangular tank shall be provided to receive C light molasses from C double cured centrifugal machine. The tank shall be of mild steel construction.

Capacity	:	1.0 m^3
Plate thickness	:	6 mm

ix) C light molasses pumps : 2 Nos.

Two C light molasses pumps shall be provided to pump CL from CL molasses receiving tank to CL molasses storage tank located at pan floor. One working and one standby.

Type	:	Screw type
Capacity	:	6 $m.^3$
Head	:	30 m

x) C massecuite Centrifugal pug mill : 1 No.

One pug mill which shall be of U shape open top, carbon steel welded construction suitable for accommodating three continuous centrifugal machines of 1100 mm diameter. The pug mill shall be fitted with a paddle type stirrer gear, shaft, and couplings. Suitable bearings, shaft seals and necessary fittings and mountings. The pug mill shall be driven by total enclosed motor through planetary gear directly coupled to the shaft.

Net capacity of the pug mill	:	5 m^3, Suitable to feed 3 # 1100 mm Basket diameter continuous
Plate thickness		
Shell	:	6 mm
End plate	:	8 mm

Each C massecuite centrifugal machine shall be provided suitable transient heater for heating C massecuite before entering centrifugal machine. Suitable thermic fluid shall be used for heating C massecuite in transient heaters.

xi) C centrifugal machine (CFW) : 2 Nos.

Each continuous centrifugal machine shall be of vertical basket, under driven type with 0.05 mm screen size. The centrifugal machine shall be complete with all accessories.

Basket dia	:	1100 mm
Type	:	Vertical, under driven
Capacity	:	6-8 T/hr (with 0.05 mm screen)
Gravity factor	:	2200

xii) C Sugar magma mixer : 1 No.

One C sugar magma mixer shall be provided for magmatising a sugar received from continuous centrifugal machines. The magma mixer shall be horizontal, U shape, open top, mild steel construction suitable for three continuous machines. The magma mixer shall be provided with double paddle type stirrer, planetary gear box shall be used to reduce the final motor speed. Both the motor and gear box are directly coupled to the shaft.

Capacity	:	3 m^3, Suitable for 3 continuous machines
Stirrer speed	:	16 rpm
Plate thickness		
Shell	:	6 mm
End plate	:	8 mm

xiii) C fore worker magma pumps : 2 Nos.

Two C sugar magma pumps shall be provided (one pump working and one standby) to pump C sugar magma mixer to C double cured sugar centrifugal pug mill.

Type	:	Rota
Capacity	:	6 $m.^3$
Head	:	20 m

xiv) Incoming panel

The main incoming panel common for all continuous machines, shall be provided with the following :-

- ACB of adequate capacity
- Ammeter with selector switch
- Voltmeter with selector switch
- Necessary fuses
- Indicating lamps
- Overload with short circuit current protection

- ❖ Any other as necessary

xv) Motor Control panel

Motor control panel of all continuous centrifugal machines shall be designed for a symmetric fault level of 35 K amps. (rpm) for one second. All components shall be front mounting type for ease of maintenance, operation and control.

The control panel of IP-54 protection shall mount switch gear, signal lamps, safety devices for tripping motor in case of high temperature motor winding, high temperature of bearing and excessive vibration of machines etc.

xvi) Operational panel

The operator panel mounted near each machine shall have start / stop push button, ammeter, "ON" signal lamp.

xvii) Cabling

All Interconnecting cabling between the main incoming panel and the machines and accessories are included.

Mono rail with 3.0 tons capacity chain pulley block over the centrifugal machines to be provided.

All magma pumps should have steam connections with NRV. The speed of the magma pumps not to exceed 36 rpm.
A suitable platform should be provided near the pug mills with proper approach from centrifugal platform.

2.17 Sugar melter : 1 Unit

One vertical, Cylindrical continuous type melter for melting lumps, rori and magma sugar shall be of mild steel construction and fitted with stirrer. The melter shall be provided with auto brix and temperature control.

Capacity for melting	:	15 tons/hr
Speed of the stirrer	:	24 rpm
Plate thickness	:	10 mm
Reduction gear box		
Type	:	Planetary
Service factor	:	2.0 (min.)
Motor	:	3 H.P.

The melter shall be provided, one outlet connection of 100 NB, steam heating coil of 50 NB, steam inlet pipe, 80 NB. Hot water inlet connection, 50 NB, and a drain valve of 100 NB.

Exhaust connection at 1.2 kg / cm^2(g). Pressure shall be used for melting.

Melt clarification one units (Phosphofloatation process)

Overflow of melt from melter shall be taken to vibratory screen to separate fine and undissolved material from melter. Two vibratory screens shall be provided. One working and one standby. The vibratory screens shall be stainless steel construction and capacity shall be suitable to handle 40 m^3/hr of sugar melt.

i) Melt buffer tank : One unit

One melt buffer tank shall be provided to receive screened melt from vibratory screens. The capacity of the tank shall be 30 m^3 and located at ground floor.

ii) Screened melt pump with drive : Two Nos.

Two screened melt pumps shall be provided to pump screened melt pump from buffer tank to Direct contact heater or Tubular heater to heat the melt inline before pumping to reaction tank from 70 to 85 deg.C using evaporator vapour.

iii) Reaction tank with agitator with drive : One unit

A suitable capacity reaction tank with agitator shall be provided.

iv) Cavitations aerator with drive : One unit

One cavitations aerator shall be provided.

v) Floatation clarifier : One unit

One floatation clarifier having capacity of 10 m^3 shall be provided. The floatation clarifier shall be complete driving mechanism with variable speed drive head with motor.

vi) Flocculent preparation tank : One unit

One vertical, cylindrical, conical bottom tank shall be provided for preparation of flocculent, compressed air connection shall be provided for uniform mixing and agitation of flocculent solution. Condensate of 50 – 60 deg. C shall be used for preparation of flocculent.

Capacity	:	0.5 m^3
MOC	:	Carbon steel with epoxy coating in side

vii) Flocculent storage tank : One unit

One vertical, cylindrical, conical bottom tank shall be provided for dosing flocculent, compressed air connection shall be provided to spurge for uniform mixing and agitation of the flocculent solution.

viii) Flocculent dosing pumps : Two Nos.

Two flocculent dosing pumps shall be provided to pump flocculent from dosing tank to inline mixer. One working and one standby.

Type	:	variable speed metering
Capacity	:	0 – 10 l/min.
Head	:	20 m
MOC	:	S.S.
Drive	:	AC VFD

ix) Lime sucrate preparation tank : One No.

One vertical cylindrical, conical bottom open top fitted with stirrer shall be provided to storage lime sucrate.

Capacity : 5 m^3

Gear box : planetary
Motor : Suitable H.P.

x) Lime sucrate dosing pump : Two Nos.

Two lime sucrate proportioning pumps shall be provided to pump lime sucrate to melt in proportion to melt flow rate. The lime proportionate system shall be automated for adding exact quantity of lime sucrate to melt. One working and one standby.

Capacity : 10 litre/min
Head : 20 m

xi) Phosphoric Acid storage tank : One Unit

One vertical, cylindrical open top S S tank for preparation of phosphoric acid shall be provided. The tank shall be fitted with stirrer. The tank shall be provided with electrically operated paddle type stirrer for preparation of phosphoric acid. One outlet connection and a drain connection.

Capacity : 1 m^3

xii) Phosphoric acid dosing pumps : Two Nos.

Two pumps shall be provided to pump phosphoric acid from dosing tank to sugar melt. One working and one standby having a capacity of each 2 litre/min, with variable speed metering pump with head of 20 m.

xiii) Colour precipitant tank : One unit

One vertical, cylindrical open top stainless steel tank for preparation of colour precipitant shall be provided.

Capacity : 1 m^3

xiv) Colour precipitant dosing pumps : Two Nos.

Two pumps shall be provided to pump colour precipitant from the storage tank to sugar melt. One working and one standby.

Capacity : 10 litre/min. (each)

xv) Clear melt tank : One unit

One vertical, cylindrical, carbon steel fabricated closed top with vent shall be provided to receive clear melt from flotation clarifier.

Capacity : 30 m^3

xvi) Colour precipitant reactor : One unit

One suitable capacity colour precipitant reactor shall be provided.

xvii) Antifoam tank : Two Nos.

Two antifoam tank of suitable capacity shall be provided

xviii) Scum tank : One unit

One cylindrical, vertical, conical bottom open top scum tank shall be provided to receive scum from flotation clarifier.

Capacity : $10m^3$

xix) Desweetening clarifier : One unit

One desweetening clarifier of having capacity 5 m^3 with cavitation type aerator shall be provided. The scum shall be sent to rotary mud filter and reprocessed to recover the sugar by mixing with vacuum filter mud. Sweet water shall be returned to process for sugar melting at melter.

xx) Control for floatation clarifier

Magnetic flow meter with transmitter for flocculant dosing, colour precipitant dosing and phosphoric acid shall be provided. All necessary level controller, pressure transmitter, temperature transmitter, flow control valves required for control shall be provided.

2.18 Sugar Handling System

a) Sugar receiving gross hopper : 1 No.

One receiving hopper vibratory type shall be provided below batch type A-centrifugal machines. The hopper shall be made of M.S. plate and will be suitable to convey 10 -12 t/hr.

Effective width	:	1500 mm
Length	:	12000 mm
Drive	:	10 BHP TEFC motor.

b) Inclined Sugar Belt Conveyor : 1 No.

An inclined toughed belt conveyor positioned to received wet sugar from the grass hopper conveyor and discharge to the FBD in let chute.

Capacity	:	10 Tons/hr.
Length C/C.	:	12 meter (approx.)
Inclination	:	not to exceed 16 º (to suite the height of the FBD in let chute and the layout)
Belt width	:	800 mm.

c) Fluidized Bed Sugar Dryer : One unit

To dry and cool the sugar received from belt conveyor suitable for bagging. The FBD shall be designed for the following duty conditions.

Capacity	:	10 Tons/hr.
Initial sugar moisture	:	1.5%(approx)
Final moisture	:	0.04 %(Max)
Initial temp.	:	60ºC (approx)
Final temp.	:	8 ºC above cooling air temp.

The supply shall be complete with hot & cooled air blower , air heater, ID fan, FD fan & dust collection for the system.

d) Sugar Elevator with drive : One unit

One vertical steel caged elevator shall be provided to elevate sugar from second gross conveyor to the grader fitted with two strand chain and GI/SS 409 M buckets.

Capacity	:	15 t/hr.
Speed	:	25 m/minute
Height	:	To suit layout

e) Sugar Grader with drive : One unit

One vibratory type sugar grader with four docks shall be provided capable of screening any grade of sugar according to IS specifications. Each deck capable to sieve minimum 7 tons of sugar

Type	:	Vibratory type
Capacity	:	15 t/hr.
Grader shall conform to	:	
Vibrating type	:	Mechanical / Electrical screen
Material	:	Stainless steel
Width	:	As per design
Length	:	As per design
Drive	:	TEFC Squirrel cage suitable for 400 V,
Motor		3 phase 50 HZ

The grader shall include :

- Sugar distributor for distributing the sugar over full width of the screen.
- Lumps separation arrangement
- Magnetic separator for each chute
- Height under grader : not less than 1000 mm

f) Dry seed belt conveyer to pan floor One unit

One belt conveyor shall be used to convey dry seed sugar from last chute of the sugar grader to dry seed mingler located at pan floor. The belt conveyer shall be supplied as per layout with a carrying capacity of 5 t/hr of dry sugar. Conveyer shall be driven by an electric motor/gear reducer, motor to be explosion proof, removable covers shall be fitted to the conveyer staging.

g) Sugar bins with AUTOMATIC weighing, filling AND STITCHING arrangement

Three cylindrical, vertical, conical bottom closed top sugar storage bins of 50 t storage capacity shall be Corrugated galvanized iron construction for storing sugar before bagging shall be provided. The bin shall be with one discharge chute and shall be provided bag filling and weighing arrangement. The bins shall be used for filling and bagging of 50 kg/100 kg of any grade. The graded sugar discharge directly into sugar bins from sugar grader chutes. 3 Nos. automatic weighing machines of high accuracy are to be fitted to each silo hopper with control gates. The sugar is then weighed automatically and discharge into bags which is clamped and released electronically. Pneucimatically the bag when released comes on a slat conveyor and then it is stitched on a heavy duty bag stitching machine.

Specification of Silos each

Side wall sheet	:	5 mm
Hopper panel sheet	:	5 mm
Roof sheet thickness	:	5 mm
Bottom hopper cone	:	30 deg.
Overall height	:	As per layout
Shell dia	:	3000 mm

Each discharge chute shall be provided with magnet before sugar is discharged into bags. The bin shall be provided with cage ladder, observation window and landing.

Potable - Sugar bag belt conveyor for transporting 50 kg sugar bags. – Ten Nos.

Potable sugar bag belt conveying system of belt width 1000 mm and of length 6.5 m along with drive shall be provided to convey sugar bags of 50/100 kg net weight to sugar godown from sugar house.

One no. Sugar. Bag stacker alongwith drive for lifting bag upto ten meter height in sugar godown for stacking shall be provided

Type	:	Flat bed type belt
Capacity	:	600 bags/hr.
Material to be handled	:	Sugar bags of 50/100 Kg.

Belt conveyor specification:

Width	:	1000 mm
Length	:	To suit layout (approx-6.5 mtr.)
Speed	:	30m/min.

The carrying idlers shall be of one roll type at suitable pitch. Drive shall be by electric motor through suitable planetary reduction gear box. Tensioning device shall be screw type.

Motor	:	TEFC squirrel cage suitable for 415 V, 3 Phase, 50 Hz.
BHP	:	2 K W , 1440 RPM
Gear box	:	Helical type to transmit 2 KW power. Min. service factor-1.7

2.19 Final molasses receiving tank : 1 No.

One vertical, rectangular tank shall be provided to receive final molasses from C fore centrifugal machine. The tank shall be of mild steel constructions. Tank shall be provided with outlet connection to suction of molasses pumps and a drain connection.

Capacity	:	6 m^3/hr.
Thickness	:	6 mm
Outlet connection	:	100 NB
Drain	:	80 NB

a) Final molasses pump with drive : 2 nos.

Two final molasses pumps shall be provided to pump final molasses from final molasses receiving tank to final molasses weighing scale. One working and one standby.

Type	:	Screw type
Capacity	:	6 m^3/hr.
Head	:	20 m

b) Final molasses weighing scale : 1 no.

The automatic load cell type final molasses weighing scale shall be provided for weighing final molasses.

Capacity of weighing scale	:	1.5 Tons / tip
No. of tips	:	5 tips/hr (min.)
Quantity	:	1 no.

i) Weighed molasses receiving tank

One vertical rectangular tank shall be provided to receive final molasses from weighing scale. The tank shall be of mild steel construction. Tank shall be provided with outlet connection to suction of molasses pump and a drain connection.

Capacity	:	3 m^3/hr.
Thickness	:	6 mm
Outlet connection	:	100 mm
Drain	:	80 mm

ii) Final molasses pump with drive : 2 Nos.

Two final molasses pumps shall be provided to pump final molasses from weighed final molasses receiving tank to final molasses storage at a distance of about 100 m from factory shall be provided. One working and one standby

Type	:	Screw type
Capacity	:	10 m^3/hr.
Head	:	30 m

iii) Final molasses storage tank : 2 Nos.

Two final molasses storage tank shall be provided to store final molasses outside the factory building. Arrangement for spraying water on sides of tank shall be provided. The tank shall be fabricated according to IS 5521 : 1980. The tank shall be provided accessories like molasses outlet, outlet discharge valve, molasses inlet, thermometer, manhole, safety railing, ladder outside the tank, level indicator etc.
Volume of tank : **3500 m^3 each.**

iv) Final molasses loading pump with drive: 2 Nos.

The final molasses pumps shall be provided to load final molasses from final molasses storage tank to overhead tank of 10 m^3 capacity shall be installed on staging at a height of 5 metes from ground floor with a 300 mm discharge line and valve to supply molasses to the tanker directly by gravity.

Type	:	Screw type
Capacity	:	10 m^3/hr.
Head	:	20 m

2.20 Service water tank

Three rectangular overhead tanks of 6 mm thick mild steel plates with stiffeners and angle frame each having a capacity of 200 HL complete with valves, fittings, pipes shall be provided. Bottom of the tanks shall be at least 6 meters have Pan Floor. Tanks shall be covered. Level indicators to be provided.

Two electric driven centrifugal pumps, each having a capacity of 150 m^3/hour at 30 meters head complete with pipes and valves NRV from the pump to the service tanks shall be provided at suitable place.

Suitable size cold water under ground reservoir made of RCC shall be provided by the purchaser to collect cold water pumped from tubewell / cannel.

A suitable capacity water reservoir for collecting water for one month to be provided by purchaser.

2.21 Water recirculation system

Necessary arrangement shall be provided for recirculation of cooling water from Power turbine, mill bearings, enclosed mill drive gear boxes, crystallizers, air compressors and Sulphur burners etc. Al equipments like MS fabricated collection tank of suitable capacity, 2 nos. pumping sets (one as standby), piping, valves etc be installed at suitable location. This water shall be pumped to raw water reservoir through spray nozzles installed of the reservoir itself to achieve atmospheric cooling.

3.0 STEAM GENERATION

3.1 One number bagasse fired, traveling grate, water tube Boiler of 40 tonnes per hour capacity suitable for generating steam at 72 ATA, 510 ± 5 deg C at super-heater outlet ,with air heater & economizer as heat recovery units with a view to obtain rated boiler efficiency 70 % on gross calorific value of bagasse has been proposed. The boiler shall be provided with a ESP for limiting the Solid Particulate Matter (SPM) level in stack gases to less than 50 mg/NM3 to meet the environmental standards applicable to sugar mills **or as prescribed by Raj. State Pollution Control Board (RPCB)**

Boiler will utilize bagasse as fuel during the season and the saved bagasse in the off-season.

❖ MCR (Max. Continuous Rating)	40 tonnes per hour
❖ Furnace type	Travelling grate
❖ Peak generation	110% of MCR
❖ Pressure at super-heater outlet	72 Ata
❖ Temperature of steam at SH	510 ±5ºC
❖ Feed water temp.	105ºC
❖ Excess air % theoretical air	Not exceeding 35%
❖ Temp. of flue gases at outlet of air heater	160°C. Max.
❖ Efficiency at MCR	70% on GCV of bagasse
❖ Fuel	**Bagasse** of 50% moist
❖ Furnace type	Membrane wall
❖ Installation	Outdoor, high set design at 5.0 m above FFL.

Boiler shall be provided with minimum one steam drum and one lower drum both of fusion welded construction. The drum shall be provided with suitable dished ends, manhole doors on each side, fitted with cross-bars, studs and nuts at each end. The

steam drum of the boiler shall be provided with primary separators of S.S. steel construction and secondary to promote circulation and ensure high steam purity.

Boiler headers shall be constructed in accordance with IBR specifications with flanged ends to promote cleaning and inspection.

The boiler shall be provided with super heater to achieve a final steam temp of 510+/-5 deg. C at 60 to 110% MCR and complete with inter-connected pipelines between the boiler and superheater, mountings such as safety valves, drain/air vent valves, pressure gauges etc. as per IBR.

The tube elements of the superheater would be suitably thick constructed from seamless alloy steel tubes specification. The tube elements of the superheater shall be expanded into the steam drum at one end and butt welded/expanded to the outlet manifold at the other end.

The superheater manifold shall be fabricated from solid drawn seamless pipes. The manifold shall be supplied complete with branches for main steam take off safety valve, air release connection etc.
A thermowell in the outlet manifold shall be provided to measure the temperature of superheated steam. The superheater design should be such that the temperature of steam at superheater outlet should not go above 515 deg.C.

A spray attempertor or heat exchanger attemperator in between primary and secondry coils of superheater to be provided to maintain automatically the temperature of steam at superheater outlet 510±5ºC at steam flow rate between 60 to 110% of MCR and tube elements of the superheater shall be constructed from seamless alloy steel tubes of SA 213 T 11 specification or equivalent for primary coils (1st stage) and SA 213 T22 specification or equivalent for Secondary coils (2nd stage) and of 4.0 mm thick.

Traveling grate Furness with spreader stoker pneumatic type to burn bagasse with 50 to 52 percent moisture with preheated air shall be provided for the boiler. Furnace shall be designed to give maximum continuous rating with bagasse firing only even when furnace chamber(s) are being cleaned.

Suitable number of rotary feeders coupled to individual variable speed drive of positively infinitely variable type for regulating the quantity of bagasse to furnaces shall be provided. The feeders shall have speed variation and maximum speed not to exceed 25 RPM. Suitable bagasse storage bunker (bagasse silo) of ten minutes storage capacity for each feeder shall be provided.

The ID fan shall be of designed for a minimum discharge capacity of 42M³/sec. The shaft of the fan shall conform to 40 C 8 of IS:1570-1978. Renewable hard faced wear pads on the blades shall be incorporated in the impeller. ID Fan shall be driven by AC VVVF motor directly coupled. The Fan rated speed shall not be more than 750 RPM. The impeller of the fan shall be fabricated out of minimum 6 mm thick mild steel. The fan shall be provided with dampers at the inlet as well as at the outlet. The impeller of the fan should be supported bearing on both the ends the shaft.

Primary air for combustion shall be supplied by the forced draft fan DEDW type, through air heater and shall be supplied to the furnace underneath the grate. The Fan shall be designed for a minimum discharge capacity of 22M³/sec. Variable inlet vane control damper in the suction of the FD fan shall be provided. FD fan shall be driven by AC VVVF motor directly coupled. The blades of fan rotor shall be fabricated out of minimum 5 mm thick mild steel plates. The rotors of the ID & FD Fans shall be dynamically balanced. The rpm of the FD fan should not be more than 960 rpm. ID fan should be interlocked so that FD runs only when ID fan is running.

Secondary air fan of 8M³/sec. and 600MM W.G.along with TEFC squirrel cage motor shall be supplied. This will supply air into the furnace as a secondary air at high pressure through heat resisting nozzles for ensuring combustion completeness. The secondary air nozzles shall be installed in the furnace walls. From the same fan air shall be supplied to the pneumatic distributors to distribute the bagasse on to the grate uniformly. The isolating/ controlling damper shall be provided at the fan suction and in the duct at a branching point. The suction of fan shall have provision for cold air as well as hot air from air heater with two separate dampers for hot air and cold air. The rpm of secondary fan shall be not more than 1440rpm.

Ash handling system comprising of various belt conveyor should be provided layout to be got approved.

Continuous blow down equipment as per IBR complete with all piping connected to the M.S blowdown tank within 10 meters outside the boiler house. Vapour Recovery arrangement shall be provided for blow down water.

Suitable surplus bagasse storage and return feed system to be provided.

Steam operated hand controlled soot blowing equipment having minimum 4 nos. soot blowers for boiler at appropriate places to cover bank of boiler tubes and one no. automatic motorized retractable soot blower for superheater elements shall be provided. Additional steam operated hand controlled soot blower(s) shall also be provided for the Economizer.

3.2 Instrumentation and Controls :

The instrument control panel to be totally enclosed in a cubicle for dust free conditions by providing an exhaust fan on the panel. The control panel shall be properly wired, tubed and connected to all field transmitters and instruments as per standard instrumentation practice. It should be housed in A.C. room, suitably sized, designed and constructed by the Purchaser. Air conditioning equipment for the control room to be provided by the seller.

A. The following instrumentation systems are to be provided:

i) Steam flow meter of indicating, integrating and recording (in data logger) type.

ii) Feed water flow meter of indicating, integrating and recording (in data logger) type.

iii) Drum water level indicating and recording (in data logger) type.

iv) Superheated pressure indicating and recording (in data logger) type.

v) Multipoint temperature scanner interface with ‘ K/J ’ type thermocouple and universal temperature transmitters with linear output for each parameter as follows:

a) Superheater steam at final superheater outlet and primary superheater outlet.
b) Feed water at deaerator inlet
c) Feed water economizer inlet
d) Feed water at economizer outlet
e) Flue gas temp. at boiler outlet
f) Flue gas temp. at economizer outlet
g) Flue gas temp. at air heater outlet

h) Flue gas at I.D fan inlet
i) Air temp. at air heater inlet.
j) Air temp. at air heater outlet
k) Furnace temp.

vi) **Draft gauges.**

a) F.D fan discharge
b) I.D fan suction
c) Furnace
d) Flue gas at boiler outlet
e) Flue gas at economizer outlet
f) Flue gas at air heater outlet
g) Flue gas at fly ash arrestor inlet
h) Flue gas at fly ash arrestor outlet
i) Air at air heater outlet

vii) **CO_2 & O_2** analyser with signal connection to data logger.

viii) Pressure gauges of size 250 mm diameter with S.S. syphon and isolation valve to be provided at boiler drum, superheater outlet steam and at fire door level for superheater outlet steam.

Pressure gauges of size 250 mm diameter with S.S. syphon and isolation valve to be provided at economizer inlet, economizer outlet, at each feed water pump outlet and feed water pumps common header.

ix) Microprocessor based 24 channel data logger programmable to any type of inputs like current, mv, T/C and digital for recording the following parameters with 80 column dot matrix printer and relay output for 8 channels for annunciation.

a) Steam flow
b) Feed water flow
c) Superheater steam temp. at primary outlet
d) Superheater steam temp. at secondary outlet
e) Superheater steam pressure at secondary outlet.
f) Drum level
g) Deaerator level
h) Deaerator pressure
i) Furnace pressure
j) Air flowFeed water at economizer inlet
k) Feed water at economizer outlet
l) Feed water at deaerator inlet
m) Flue as temp. at boiler outlet
n) Flue gas temp. at economizer outlet
o) Flue gas temp. at air heater outlet
p) Flue gas temp. ID fan inlet
q) Air temp. at air heater inlet
r) Air temp. at air heater outlet
s) Furnace temp.
t) CO_2 & O_2

B) Micro processor based annunciator with electronic hooter to be provided for the following:
a) Feed water tank level low
b) Deaerator tank level low Deaerator tank level high
c) Drum water level low
d) Drum water level high

e) Superheater steam temp. high
f) ID fan trip
g) FD fan trip
h) SA fan trip
i) Feed water pump trip
j) Bagasse feeder trip
k) Feed water transfer trip

C) The following auto controller to be provided with the boiler:

i) Three element drum level control system: Drum level shall be automatically controlled using the three element control philosophy to ensure quick response of the system. In case of drum level falls below minimum level, the feed water control valve will open fully. In case drum level rises above maximum level, the feed water control valve will close fully.

ii) Deaerator pressure and level control system: Deaerator pressure shall be maintained by regulating the steam flow to the deaerator so that temperature of boiler feed water is maintained at the desired set value. Deaerator level shall be controlled so as to balance the inflow and out- flow of feed water.

iii) Cascaded superheater steam temperature control system: based on measuring temperature at outlet of primary superheater header and final superheater header.

iv) Combustion control system: This will be an integrated control loop for maintaining the steam pressure. According to the steam pressure the master controller will adjust rotary feeder speed to feed more or less fuel to the boiler and FD/ID fan to control amount of primary air/flue gas respectively. To ensure that this adjustment is correct, the signal of CO2 % in flue gases will be taken in the loop to make the final correction in the combustion air/flue gas flow.

v) Furnace pressure control system: ID fan speed shall be controlled to maintain draft in side the furnace to – 3-5mm WC.

(D) Two air compressors (one as standby) shall be provided to supply oil and moisture free air through suitable dryer system, for pneumatically controlled instruments. Spare air filtering and drying system shall also be provided along with standby compressor.

Or

Computerized Boiler Automation

The computerized scalable process control system shall be provided to achieve the above referred measurements, control & audio- visual alarms for the safe and smooth operation of the boiler. The system shall have the following features and facilities :-

- ❖ Data aquisition and monitoring.
- ❖ Data logging.
- ❖ Alarm and event logging.
- ❖ Dynamic trend for 32 channels.
- ❖ Three dimensional graphic display.
- ❖ Free format report generation for customized reports.
- ❖ Online mathematical computation for any physical and virtual channels.
- ❖ Printer hard copy.
- ❖ Loop wise scan time selection.
- ❖ Card replacement without power shutdown.
- ❖ Latest communication standards like HART/Foundation field bus.

3.3 Economizer

An economizer having adequate heating surface with 4.0 mm thick tubes shall be provided. Economizer shall be complete with coils, supports, thermo wells for measuring inlet and outlet water temperature, casing and ducting, soot blower, lagging etc. The economizer shall be designed in accordance with the requirement of IBR. The system should have Bye-pass arrangement for flue gas and water circulation. The rise in temperature of feed water in economizer should be about 60ºC less than saturation temperature of the drum water.

3.4 Air pre-heater

Air heater having adequate heating surface to heat the air by flue gases required for combustion shall be provided. Air heater shall be complete in all respects with 10 SWG thick ERW tubes, tube plates, support, dampers, casing and ducting etc. Entry of cold air shall be distributed properly over the length of air heater to avoid condensation of moisture. Tube plates thickness shall be minimum 25mm.

The air heater and economizer shall be designed so as to give final flue gas temp. of max. 160 deg.C. The air outlet temp. should not exceed 220 deg C.

3.5 ESP for arresting fly ash

a) The ESP shall be such design suitable for achieving following parameters :-

Gas Flow Rate	=	Corresponding to MCR of the boiler
Temperature of gasses at entry	=	<160°C
Inlet Dust concentration	=	5.0g/Nm³
Outlet Emission (concentration) at exit	=	<50mg/Nm³ **or as prescribed by RSPCB**
Pressure Drop across system for	=	<25mm

The ESP of suitable capacity highly efficient single ventury type shall be designed so that the dust emission at the outlet of the chimney should be limited to 50mg/NM³ or as prescribed by State Pollution Control Board. The ESP shall be installed on the suction side of ID fan and shall be complete with rotary air lock valve with drive provided with local and remote push button control and a side manual gate. The minimum elevation of the discharge flange of the rotary air lock valve shall be at +2500mm suitable platform, MS steel staging, ladders, staircases, railing, inspection and packing holes shall be included in the scope of supply. The ESP should be properly insulated with aluminium cladding & be provided with indication for ash level, low and high temperature alarm, water washing arrangement Control Panels, rectifier control panels complete in all respects. It should be provided with suitable ash handling system.

b) Boiler feed water tank

One cylindrical closed mild steel tank shall be of 300 HL capacity with inlet connections for condensate, treated water, chemical dosing arrangements, outlets connections, for transfer pumps, overflow connection, air vent connection etc. Feed water tank shall be supported on steel supporting structure. Bottom of the tank shall not be less than 8 meter height from the transfer pump suction.

Two nos. transfer pumps (one as standby) each of 50 m³/hr capacity and 60M head to pump water from boiler feed water tank to Deaerator to maintain 4 kg/cm2 g pressure at the nozzles of Deaerator shall be provided.

c) De-aerator

Deaerater mounted on de-aerated water tank of 300 HL capacity and suitable for maximum flow rate of 80 m³ per hour shall be provided to obtain a temperature rise of feed water from 85 deg.C to 105 deg.C by using exhaust steam at 0.5 - 1.5 kg/cm2

gauge. The maximum dissolved oxygen in the deaerater water shall not be more than 0.007 ppm. at 105 deg.C. temp. The deaerator tank shall be installed at a height of 8 metres from the feed pump suction and shall have platform around the tank, it shall have high and low level alarm along with gauge glasses.
Common staging for boiler feed water tank and de-aerator shall be provided.

d) HP Heater

1 No. HP heater is to preheat the feed water from 105^0C to 160^0 with inlet / outlet isolation valves, drain valves and fittings, level control valve, drain and vent lines to de-aerator. The HP heater should be shell and tube type designed to improve the boiler plant efficiency. The heater will be located downstream of the feed water pumps, with the feed water passing through the tubes of the heater. The steam shall be bled from the TG set (1^{st} extraction) at 6 ata, to be used as heating medium on the shell side. The feed water entering the heater at about 105^0C will be heated to 160^0C . The condensate of the heating steam will be cascaded to the deaerator. A suitable by-pass arrangement shall be provided for by-passing the heater. All the valves for the feed water outlet and the by-pass shall be motor operated. The steam inlet line valve to HP heater shall also be motor operated. In case of high condensation in the heater shell, all the valves will close automatically to isolate the heater and ensure that there is no water induction into the turbine. The HP heater condensate level is to be controlled by a level control system.

e) Chemical dozing equipments

The boiler shall be supplied with chemical dosing systems one for high pressure dosing and other for low pressure dosing. Each system shall consist of chemical proportioning tanks, two nos. positive displacement type dosing pumps, valves and measuring instruments. Each mixing tank shall have rubber linings from inside and shall be fitted with motorized stirrer. The capacity of each tank shall be of 400 litres. The chemical dosing system equipment shall be located near feed water station on the ground floor.

f) Boiler feed water pumps

Three pumps (one as standby) each of 30 m^3 per hour capacity and suitable head shall be provided.

Each multistage electrical driven pump shall be suitable for pumping hot water at 160 deg.C. to boiler. 2% leak-off connection shall be provided for each pump. Electric motor of TEFC sq. cage type with auto transformer/soft starter shall be provided. The starting current should not exceed the 300% of full load current.

g) RCC Chimney : (In the scope of purchaser)

One R.C.C. Chimney of 3.0 meter. Inside dia meter at top and height 45 meters as per pollution board norms, shall be constructed along with ladder with guard. Besides, refractory lining up to 10 M height, lightening arrestor and M.S. frame and necessary ducting shall be provided by purchaser. Design of chimney and details of chimney inlet to be furnished by the seller.

Lightening arrestor to be also provided in the chimney.

h) Boiler Feed Water Treatment Plant

A R.O plant of 10 m3/hr capacity shall be provided to suit the water requirement of the boiler(Raw water analysis report is available at annexure XXI) . A M.S. storage tank of 1500 H.L capacity, shall be included to store the treated water from the treatment plant. Two pumps of 50 m3/hr capacity and of 25 meters head shall be provided to pump the water from treated water storage tank to feed water tank.

A polishing plant for hot condensate from evaporators & pan along with cooling system having capacity of 10m3/Hr and one storage tank of 40m3 M.S. construction shall be provided.

i) Ash Handling System.

Suitable ash handling system collecting ash from furnace, combustion chamber , Economizer, air heater and ESP shall be transported by belt conveyors to a silo, shall be provided.

j) High pressure Steam Distribution header

One no. steam distribution header of 400 mm NB with same size flanged ends on either side and provided with the following flanged tapings for collecting the steam and distribution it to various units to be provided. All High pressure piping shall confirm to IBR.

- One 200 mm inlet opening for boiler with gate valve.
- One 200 mm inlet opening with dummy for future boiler.
- One 150 mm outlet opening with Gate Valve for T.G.Set.
- One 200 mm outlet opening with dummy for future T.G.Set.
- One 150 mm opening with globe valve for PRD.
- Two nos. 150 mm openings with dummy.
- Provision for pressure gauge and thermometer.
- One drain at each end.

De-superheating & PRDS station *Recommendation*

Suitable steam pressure reducing and de-superheating equipment shall be provided as per following details:

Qty	Type	Capacity	Description
1.	De-superheating station	5.0 T/hr	De-superheating steam at 7 – 8 kg/cm^{2}g
2.	De-superheating station	30 T/hr	De-superheating steam at 2.0 kg/cm^{2}g

There should be provision for adjusting the pressure in exhaust steam receiver at any preset value between 0.5 – 1.5 kg/cm^2 g .

Two pressure pumps of suitable drive for injecting water in the two reduced pressure steam lines through pneumatically operated control valves .

One steam flow meter shall be provided in high pressure side of PRDS unit .

Material of construction and general instructions :

The boiler shall be manufactured in accordance with the requirements of Indian Boiler Rules and Regulations/ISO. The boiler shall be provided with a steel supporting structure from rolled steel sections and designed with adequate strength for the loads imposed by the boiler and associated equipments. The boiler shall be complete with necessary tubes, manifolds, integral pipe works, mountings and fittings with valves, gauges, high and low water alarm, maintenance tools consisting of expander, mandrills, ratchets two grease guns and a set of spanners, water gauges, chemical injection valves etc.

The integral pipe work shall consists of blow-off bends, high and low pressure drains, water gauge piping, water and steam connections to the feed water regulator, piping

from feed control valve to economizer inlet manifold, feed piping from economizer outlet manifold to the boiler steam drum, pressure gauge piping soot blower steam supply pipe works, safety valves escape pipe work etc.

The boiler shall be provided with a three element type automatic feed water regulator of the electric/pneumatic controller type, which shall respond to momentary fluctuations in steam demand upto ± 5% of the rated MCR of the boiler. One hand operated control valve of cast steel (located such that its operator can see water level in gauge glass) capable of passing the required amount of water shall also be provided. The boiler shall have two water gauge glasses at the top drum independently connected.

Necessary mild steel ducting of 5 mm thick plate in case of air duct and 6 mm thick in case of gas duct with stiffeners shall be provided for the boiler, comprising of cold air ducting extending between the forced draft fan discharge and air inlet of air heater, hot air ducting from the air heater outlet to the furnace , flue gas ducting from fly ash arrestor to the chimney. All ducts of mild steel and above the ground.

Necessary regulating and isolating dampers at suitable points shall be provided for the efficient operation and maintenance of boiler. All dampers will have an effective area not less than the specified for the ducts they control.

Suitable galleries and ladders with grating or open steel flooring for affording access to the essential levels of the boiler plant complete with hand railings, curb angles and supports shall be provided.

All supporting steel work, hangers, thrust brackets and castings for the furnace shall be provided for boiler. All refractory tiles and bricks, adequate quantity of high grade refractory cement, special shaped refractory tiles cast able refractory bricks for furnace and high temperature zones shall be as per IS-8 quality. All necessary high grade insulating materials for the exposed portion of the boiler, steam and water drums, integral pipe work from the feed pumps to the boiler, steam piping, gas and hot air ducting shall also be supplied. Reinforcement with wire mesh and super coated with a hard setting material so as to protect the high grade lagging materials against damage shall also be provided. Red bricks, cement and sand also to be provided by Seller.

4.0 POWER GENERATION, DISTRIBUTION & TRANSMISSION

4.1 Power Generation:

One turbo alternator set of 6187.50 KVA (4950 KW at 0.8 power factor), 11 kv controlled extraction cum bleed cum condensing multistage turbo alternator with synchronizing and control equipment for grid.

The turbo set shall be suitable for developing rated power even when both the overload valves of the turbine are closed.

The steam turbines shall be designed for operation for the following ranges of steam parameters.

Extraction details for turbines
Season Operation

Turbine inlet flow	40.00 TPH
1st extraction at	6.0 ata, 7.0 tons/hr. max
2nd extraction at	2 ata, 29.0 tons/hr. max

Steam to condenser	4.0 tons/hr.

Off-Season Operation

Turbine inlet flow	28 TPH
1st extraction at	6.0 ata 3.0 tons/hr. max
2nd extraction at	2.0 ata 3 tons/hr. max
Steam to condenser	22.0 tons/hr. max

Inlet steam parameters

Maximum	72 kg/cm^2,g
Normal	70 kg/cm^2,g
Minimum	68 kg/cm^2 ,g

Inlet steam temperature

Maximum	515ºC
Normal	510ºC
Minimum	500ºC

The turbine shall be so designed that it suffers no damage if exhaust pressure occasionally goes down to atmospheric pressure and/or live steam temperature goes up to 515 C and pressure 74 ata Kg/cm2 g.

The turbine shall be provided with electronic- governor of woodward 505E to control the rated speed of 105%- 95% and should be capable of operating in parallel with State Electricity grid. The speed regulation of the turbine (droop characteristics) shall not exceed 4% at 4950 KW full load of the alternator.

The turbine shall be complete with high pressure stop and emergency valve, steam strainer, steam be bleed cum extraction cum condensing type. The extraction will be controlled at traps, sentinel valve, main oil pump, auxiliary electric motor driven oil pump, one DC motor driven stand by oil pump, oil cooling system consisting of two Nos oil coolers with necessary pipes and valves so that one of the two coolers can be cleaned when the turbine is working on load, steam and oil temperature and pressure gauges, gauge type spot mounted bearing temperature indicators for turbine and gear box local/direct mounted speedometers and one remote reading tachometer, oil pockets with stem type thermometers in the live steam inlet and exhaust steam outlet lines, steam flow meter for measuring steam consumption of the turbine.

Necessary oil reservoir, duplex micronic felt/self cleaning type oil filters, oil strainer, interconnecting oil, water and steam pipe work with valves and non-return valves, etc., and arrangements for automatic starting of auxiliary oil pump in case of low oil pressure shall be provided.

Suitable size of condenser having two cell induced draft cooling tower shall be provided.

The turbine control panel shall be centrally located and should be fully air conditioned. The air conditioning equipment shall be provided by the supplier and control room civil work shall be done by the purchaser.
The turbine shall have controlled extraction at 7 ata and controlled at 2.5 ata . It will also meet the low pressure steam requirement of the sugar plant and de-aerating steam requirement of the cogeneration plant. All the valves provided for extraction & bleeding shall be motorized operation through remote control.

The steam pressure and temperature required at the battery limit shall be 2.5 ata and 130^{0}C. De-super heater required to reduce steam temperature of the extraction steam

to 130^0C shall also be provided (if required). The uncontrolled extraction at 7 ata steam extracted from the turbine shall be utilized in HP heaters for heating of the feed water, ejectors for gland sealing and for vacuum in condenser and for use in the process. The balance of the steam will be condensed in the water cooled surface condenser at 0.10 ata. The turbine should be capable to develop 4.95 MW. The specific steam consumption of the turbo set should be not more than 6.25 kg / K.W. per hour at full load.

The turbine shall have solidly forged machine rotor with integral disks. The blading shall be designed to resist all vibrations, thermal shocks and other loading that shall be experienced during service and system disturbances. The turbine shall be horizontal rotor, double pedestal, multistage, nozzle governed type and should have hydraulically operated servomotor control valves to minimize manual operation. It should respond to frequent variations in load and input operating conditions and ensure efficiency even at part load.

During the start up of the machine, the steam shall be supplied externally, at the pressure indicated in the specification, for effecting the sealing through inbuilt PRSH station.

The turbine shall be provided with liberally rated hydro dynamic thrust bearings (double padestal). A pressure lubrication and control oil system shall be furnished for the turbo generator unit to supply oil at the required pressure to the steam turbine, gear box, generator and governing system.

The oil system shall include the following:

- 1 x 100% capacity, main oil pump driven by the turbine shaft / low speed gear shaft.
- 2 x 100% capacity (one operating and other standby), AC motor driven auxiliary oil pump of centrifugal type arranged to cut in automatically if the oil pressure falls to pre-set value. This pump shall also meet the requirement of oil during the start-up and shut-down.
- 2 x 100% capacity (1 working and 1 stand-by) water cooled oil coolers
- 2 x 100% duty oil filters arranged in such a way that it is possible to clean one oil filter while the other oil filter is in operation. The filters and the coolers shall be arranged with continuous flow transfer valves
- Oil storage and settling tank, level indicators and alarm contacts vent and oil mist eliminators etc.

The oil coolers shall be water cooled with a duplex arrangement and change-over valves to ease in maintenance. The coolers shall be of shell and tube type with Admiralty quality brass tubes.

Suitable full flow twin oil filters shall be used for the lube oil, down stream of the coolers and shall be piped in parallel arrangement with transfer valves. Differential pressure gauge with alarm shall be provided across the filters.

The reservoir made of carbon steel conforming to IS-2062 and interior rust proof, necessary piping, connection, valves, fitting, level switches and level gauges shall be provided for the cooling system and the oil system.

a) Governing System

The turbine shall be provided with electronic type governor of Woodward 505-E make programmable microprocessor based digital control with TG-13 activator to actuate a set of inlet governing valves and should be capable of operating in parallel with grid.

Gauges and indicators to be provided as under:-

- Steam pressure gauge
- Steam temperature gauge
- Oil pressure gauge
- Oil temperature gauges
- Bearing temperature indicator for turbine
- Bearing temperature indicator for gear box
- Speedometers at stations
- Remote reading tachometer
- Necessary oil pockets for the inlet live steam / outlet exhaust steam
- Steam flow meters

The turbine shall be provided with trip system for the complete and rapid closure of the steam valves effectively preventing all steam admission to the turbine independently of the closure of the governing valves. In order to avoid sudden re-admission of the steam to the turbine the trip system shall be fitted with inter-locking devices so that the trip re-setting cannot take place and steam admission can only be achieved as per normal starting procedure. Essential trip circuits to be provided are:

- Steam inlet pressure falling below pre-set level
- Steam temperature falling below pre-set level
- Condenser vacuum falling below pre-set level
- Lubricating oil pressure falling below pre-set level
- Axial thrust wear trip
- High temperature trip for LP stage steam flow
- Over speed trip with audio visual alarm
- Low oil pressure trip with audio visual alarm
- Turbine to trip when the alternator ACB trips due to differential protection.
- Remote operated manual trip with audio visual alarm.
- Manual trip handle on turbine.
- High back pressure trip
- High oil pressure trip
- Electronic overspreading with sensing from Speedo meter

The measuring and monitoring system shall be provided on each bearing of the turbine, generator and gear box.

b) Condenser

The condenser shall be of non contact surface type condenser with suitably designed air evacuation system complete in all respect.

The condenser shall be designed to condense normal exhaust steam quantity 25 tonne per hour for operation in off season. The condenser shall be designed to operate with 30^0C inlet cooling water.

The cooling water for the condenser will be supplied from the cooling tower basin through cold water pumps. The condenser neck shall be connected to the turbine exhaust hood. The thermal expansion of the condenser shall be suitably protected with properly designed stainless steel expansion below.

The hot well at the condenser bottom shall have a minimum capacity of 2 minutes storage while handling peak flow of steam. The hot well shall be provided with level gauges and connections for condensate extraction and drain. A suitably designed level control system shall be provided.

2 Nos. (one operating and one stand-by) of 100% capacity electrical motor driven condensate extraction pumps to pump the condensate from the condenser hot well shall be provided.

The reduction gear box between the turbine and the generator shall be of double helical arrangement with an acceptable service factor of minimum 1.5. The gear box shall be designed as per requirement of DIN/IS/BS standard. Necessary cooling arrangement for the gear box shall be provided.

The turbine shall be provided with barring gear driven by AC motors to rotate the turbine and generator after shut down to prevent thermal distortion of the rotor. The barring gear shall be capable of starting the rotor from rest and run it continuously at low speed. The barring gear shall be interlocked with the lubrication system to prevent its operation without lubrication.

c) Turbine Control

The Turbine Control shall be through centrally located distributed control system described in the boiler section of this NIT. The control system shall be provided with redundancy for key functions by use of separate sensors and monitors. The control system shall include all the standard control monitoring and alarms. The alarm sequence shall be as per internationally accepted standards. Separate windows shall be provided for pre-alarm and shut down with simultaneous alarms.

Turbine monitoring board shall have the following:

- Inlet steam pressure and temperature gauge
- Uncontrolled extraction steam pressure and temperature gauge
- Controlled extraction steam pressure and temperature gauge
- Lube oil pressure gauge
- Control oil pressure gauge
- Steam turbine/generator speed indicator
- Push button stop for turbine and generator
- Run light
- Push button for emergency shut off

Minimum supervisory instruments to measure the following shall be included in the control system:

- Monitoring of winding & bearing temperature, vibration continuously.
- Speed
- Load
- Emergency and control valve lift
- Control fluid pressure
- Axial position of thrust collar relative to its own housing
- Contacts for annunciators and alarms, as required
- Shaft eccentricity

All piping required for effectively connecting the turbine with the sub system shall be provided. The piping provided shall be complete in all respects including valves, fittings, supports etc.

d) Cooling water system

A two cell, induced draft (1 running, 1 standby) counter current flow cooling tower, to meet the cooling water requirement for the co-generation plant shall be provided. The hot water returning from the condenser, and the TG and the boiler auxiliaries to be cooled in the cooling tower designed for a temperature drop of 8^0C with an approach of 5^0C at the wet bulb temperature. The cooling tower shall be with RCC integral with basin etc.

The structure shall be designed adequately for wind and other loads and shall be as per seismic conditions. The cooling tower shall be complete in all respects such as induced draft fan, motors, gear reducers, lubrication systems etc. The fan blade to be of FRP construction to reduce energy consumption. Desk, ladders, handles etc. and access doors for each cell shall be provided. Complete isolation between the cells is essential. Chemical dosing system including necessary piping, vessels, valves, pumps and pipe work for returning cooling water to a terminal point shall be provided. All electricals including motors, supports, cable and cable works, earthing including material etc. is to be included in the scope of supply. Complete civil work shall be included in the scope of work of the purchaser.

e) Service and Potable Water System

RO plant of adequate capacity to be installed for treating the raw water to suite feed water quality.

f) Air conditioning and ventilation system

The main plant control room housing the controls for the boilers and the turbo generators shall be air conditioned with split air conditioners and suitable exhaust fans to ensure effective ventilation and dust free atmosphere within the turbo generator building required control Room shall be provided by the purchaser and Air Conditioner & accessories to be provided by the supplier.

g) Turbine supervisory system

The system shall observe all critical process parameters of the turbine continuously with following provisions:-

- Monitoring of winding & bearing temperatures, vibrations continuously.
- Audio/visual ALARM & TRIP signals.
- Set points adjustable separately for winding & bearing.
- Immune to noise signals, radiations & electromagnetic interference.
- Ultra sensitive & accurate sensors.
- Built in safety fuse & failsafe logic.
- Changeover relay contact outputs to activate buzzer or trip the turbine/motor.

The specifications of the system components shall be as specified below:-

Sensor	PT100/Thermocouple & vibration.
Accuracy	± 0.25% of FS
Display	3½ digits,7 segments
Scan Time	3 to 30 seconds adjustable.
Auto/Manual selection	Front panel switch
Set points	Adjustable with front trimpots.
Power supply	230/110 VAC; 50 Hz.

Special maintenance tools for the turbine shall be supplied along with the turbine.

The turbine shall be completed with a set of foundation bolts and leveling pads, isolating valve at steam inlet, isolating valve at extraction, extraction non-return valve, exhaust isolation valve, exhaust non-return valve and exhaust flow relief valve.

h) Generator

Generator for TG set will have nominal rating of 4950 KW with a generation voltage of 11 KV, 3 phases, 50 Hz at a rated power factor of 0.8. The generator shall be designed as per IS : 4722 specifications . The generator shall be suitable in design for min. 40 % VVVF loading. The enclosure shall be dust and waterproof.

The generator will be complete with base frame, cooling system, brush less exciter, automatic voltage regulator, lightening arrestor & surge capacitor and voltage transformer panel, relay, metering and control panels, control and safety devices and other accessories etc. The generator coupled to the steam turbine will be suitable in all respects for operating in parallel with grid.

The generator will match with the turbine in respect of speed, over speed, moment of inertia, over load capacities, coupling and other relevant requirements. The stator and rotor will have class F insulation but the temperature rise will not exceed the limits specified for class B insulation.

The generator will be fitted with RTD for monitoring the temperature, space heaters and temperature indicators.

The excitation system will be of brush less type controlled by digital two sets of AVR. Each system will have auto and manual changeover facilities. Alarms will be arranged for AVR fault.

i) Generator incoming panel (11 KV VCB)

VCB panel shall be single front draw out execution floor mounting free standing suitable for 11 KV, + 10% variation, 50 Hz frequency ± 5% variation, 3 phases 3 wire type supply system suitable for fault level 25 KA for 3 seconds.

Panel earthing should be through NGR, suitable for 50º ambient temperature and relative humidity of 95%. Panel shall be indoor type. VCB shall be electrically operated type with spring charging voltage 240 V AC and closing & tripping coils suitable for 110V DC.

Panel bus bar shall be of electric grade copper.

Panel shall have all necessary CTS, PTS, indicating lamps and other required equipments suitable for grid paralleling and operation of sugar factory. The breaker shall have suitable no. of auxiliary contact for electrical interlocking with auxiliary power supply breaker etc.

The alternator shall have neutral breaker mounted on front side of breaker panel. The neutral bus bar shall be half of phase bus bars and grade copper.

Bus bars shall be located in air-insulated enclosure and segregated from all other compartments of the cubicles. All bus bar joints and bus tap joints shall be silver faced. Panel shall have full proof earthing necessary safety interlock features etc.

Panel shall have interior illuminating lamp, space heater with thermostat suitable for 220 V AC, contactor for anti pumping, trip circuit supervision relay, spring charging handle.

Earthing trolley shall be provided to short incomer of breaker when breaker is taken out for maintenance. Panel shall be suitable for bottom cable/bus duct entry. Panel shall be suitable for extension on both sides to connect distribution panel.

Suitable interlocking with castel lock shall be provided for interlocking of the main breaker with emergency power supply breaker of grid/DG set supply and bus coupler can be switched 'ON' only when one supply breaker is ON in addition to electrical interlocking. The scheme for interlocking shall be approved by purchasers.

j) HT Cabling

HT Cabling for interconnection between generator terminals to the generator switch gear panel of suitable rating with XLPE/armored copper cables shall be provided. All other required control cables shall also be provided.

k) Metering-cum-Synchronizing Panel

Panel shall be metal enclosed free standing floor mounting type shall be dust moisture and vermin proof simplex type with IP 52 degree of protection. Panel shall have all necessary metering, indication in annunciation, synchronising equipments.

Metering – Minimum following metering shall be provided:

Ammeters & Volt meter with selector switch, KW meter, power factor meter, frequency meter, KVA meter, KVAR meter, Tri Vector meter, KWH meter and KVAH + MDI meter. Meter should be digital type of suitable ranges and ratings.

All meters shall be of 3 phase four wire type and shall be suitable for balance as well as unbalanced loads. Meter size shall be 144 mm sq., meter type moving iron type, accuracy class 0.5 FSR meters scale shall be 240 degree.

Synchronizing – (It shall have the facilities for auto and manual synchronizing) It shall have minimum following equipments: Check synchronizing relay, guard relay, synchronizing auxiliary relay, inter posing voltage transformer, double volt meter, double frequency meter, synchro scope, discrepancy control switch with all necessary indicating lamps selector switches and auto manual selector switch.

Synchronizing system should be such that 11 KV turbo set should be suitable for paralleling with grid.

Annunciation - Minimum following annunciation shall be provided:

Under voltage relay operated, Over voltage relay operated, Reverse active power relay operated, Reverse reactive power relay operated, IDMT over current relay operated, Earth fault relay operated, Generator lock out relay operated, Turbine lock out relay operated, Loss of excitation relay with under voltage relay operated, Loss of excitation relay without under voltage relay operated, Negative phase sequence relay alarm, Negative phase sequence relay operated, Under frequency relay operated, very under frequency relay operated, Over frequency relay operated, Df/Dt operated, Relay panel DC fail, Instantaneous over current relay operated, Metering and AVR PT fuse fail, Protection PT fuse fail, Excitation PT fuse fail, Winding temp. high, Over load relay operated, Generator bearing temp. high, Emergency trip push button operated, First rotor earth fault, Second rotor earth fault trip.

Annunciator shall have RS-485 communication port to communicate through Modbus communicate protocol.

Panel shall have 16 channels temperature scanner suitable for PT 100 RTDS for generator winding and bearing, cold and hot air temperature.
Scanner shall have RS-485 communication port to communicate through Modbus communicate protocol.

Codes and Standards: Panel shall generally comply with relevant Indian Standard Specification and relevant codes and practices.

l) AVR (2 Nos. Digital type) & Excitation Panel

Field excitation system shall be fitted with suitable switching device with brushless generator for field excitation system such that field current is automatically cut off from circuit in the event of turbine/generator trip. Excitation system panel shall have DC ammeter, DC V meter, shunt field regulator for manual operation of excitor with auto manual selector switch, suitable transformer indication lamps, fuses and field discharge resistance with necessary isolation facilities shall be provided.

One CT panel complete with 3 core current transformers for meters, protection, differential protection at phase and neutral side, compounding etc.

One set SCADA (supervisory control & data acquisition system) complete with PLC/ DCS System, computer with key board. SCADA package (software), distributed I/o control system, colour printer, etc. for monitoring and control various operating parameters of the TG set.

There shall be 2 no. AVR digital panels (one operating and one standby) with auto/manual selector switch with independent primary and secondary modes complete with all accessories, over voltage relay, suitable volt meter and fine voltage adjustment device, automatic power factor regulation facility suitable for gird paralleling.

AVR shall have motorized auto potential meter, facility for enabling remote raise/lower of voltage, AVR priming, short circuit maintenance features, compounding features, auto PF controlling features, follow up features, diode failure detector for excitor rotating diodes, over and under excitation limiter. Panel shall have following meter, alternator volt meter, excitor volt meter, excitor ammeter, null meter and power factor meter etc.

m) Protection relay panel

Protection relay panel shall be same in construction and other features for metering panel. Relay panel shall have minimum following protective relays:

Under voltage relay, over voltage relay with timer, reverse active power relay, reverse reactive power relay, voltage control 3 element type over current relay, earth fault relay, differential relay, generator lockout relay, turbine lockout relay, loss of excitation relay, auxiliary relay for loss of excitation relay, under voltage relay, negative phase sequence relay, four stage frequency relay with one df/dt, DC supply supervision relay, instantaneous over current relay, voltage balance relays for metering and protection PTS, instantaneous over voltage relay for excitation PT fuse fail sensing, overload relay, first rotor earth fault, second rotor earth fault relay, voltage surge relay, trip coil supervision relay, unit lockout relay.
Relay panel shall have necessary meters, switches, potentio meters etc. Differential relay shall be supplied with 3 nos. stabilizing registers and 3 nos. metrosil surge diverters. Necessary relays, if any, desired especially by the electricity regulatory authority are included in the scope of supply.

n) NGR with control panel

NGR shall be suitable for 11 KV, 3 phase, 50 Hz supply system with fault level of 25 KA for 3 seconds. Panel shall be metal enclosed free standing floor mounting type and shall be dust moisture and vermin proof. Neutral grounding equipment shall be completely assembled, wired and connected to neutral bus tap through seal off bushings.

Resistor unit mounted on the grid rods shall be fixed and assembled in tires and fitted into sheet steel enclosure. Resistor shall be able to carry specified current for the period of time as specified with temperature rise. The resistor shall also be able to carry at least 10% of its rated current continuously.

An isolator shall be provided on incoming side to isolate the resister from the main equipment. Isolater shall be provided on front of the panel. Isolating switch shall be single pole, knife type having rating of 125 times the rated current of resister. Switch shall have adequate sets of potential free auxiliary contacts for remote indication/alarm/trip signals. An external handle suitably insulated and lockable both in ON & OFF positions shall be provided for isolating switch.

NGR panel shall have all necessary metering protections and indications and ammeter for earth leakage current.

o) LAPT panel (Lightning Arrestor and Surge Protection)

LAPT panel shall be complete and shall house 11 KV search capacitors and class III discharge gapless lightning arrestors in sheet steel cubicles. LAPT panel shall have all necessary metering CTS, PTS and meters for protection metering and AVR sensing. Panel shall be suitable to connect 11 KV HT cable from at the top of the panel for incoming and at the bottom for outgoing cable of the panel.

PTS in the panel shall be cast resin, non draw out type suitable for nominal operation connected from line to ground and for 1.73 times rated line to ground voltage under sustain emergency condition. The lightening arrestor and surge capacitors shall be located in separate compartments and shall be single pole connected between line and ground terminals. The arrestor shall be station class, hermetically sealed type and shall be suitable for generator protection.

p) Turbine control panel (control desk type)

Turbine control panel shall be indoor type; desk profile type metal enclosed free standing floor mounting and shall be dust moisture and verming proof. The control disk shall have ON/OFF push buttons (illuminating type), trip indicating lamp, ammeter,local/remote selector switch for air blower motor, vapour extractor motor, actuator motor, ALOP motor, barring gear motor, ACOP motor, emergency oil pump motor. Panel shall have all necessary metering protections annunciations. Panel shall have temperature scanner for turbine and gear box bearings.

Annunciator shall have minimum following annunciation for:

Lube oil pressure low, lube oil pressure very low, control oil pressure low, differential pressure across filter high, control oil pressure very low, turbine speed high, high axial movement, condenser low vacuum, turbine lock out relay operated, solenoid trip, turbine bearing temperature high, turbine bearing temperature very high, emergency trip, Annunciator shall be solid-state microprocessor base type with taste, acknowledgment and reset push buttons.

Power supply to the annunciator shall be 110 V DC.

q) Turbine auxiliaries MCC

415 V LT MCC/switch board for T.G. Set auxiliaries shall be non draw out type single front compartmentalized suitable for three phase, four wire, 415 V, 50 Hz supply system. MCC shall have switch fuse contactor, over load relay starters for various motors required for turbine lube systems and condenser etc.

MCC shall be non draw type; free standing floor mounting type suitable for indoor operation, cable entry shall be from bottom and shall have adequately rated incoming switch fuse unit and starters for outgoing feeders.

r) ACDB (AC Distribution Board for Power House Auxiliaries)

Panel shall be metal enclosed, wall mounting type, dust and moisture and vermin proof suitable for 230 V AC single phase 50 Hz supply system. Panel shall be indoor type having 1 no. switch fuse incomer feeder and 15 nos. two pole MCB outgoing feeders for supply to various control panels.

s) DC batteries & battery charger

DC batteries shall be lead acid type conforming to Indian Standard Specification and Codes of practice. Each battery cell shall be 2 V connected in row and double tire formation for getting 110 V DC supply. Batteries shall be mounted teak wood rake complete with cell no. plates fixing nails and battery inter-connectors. Batteries shall be suitable for ambient temperature 50ºC for satisfactory operation. Total 55 number cells are required for getting 110 V DC supply to various panels.

Battery charger shall be rated for 110 V DC and suitable for maintenance free batteries. Battery charger panel shall have all necessary meters and lamps for indication purpose. Panel shall consist of two chargers, a float charger and float-cum-boost charger for trickle and boost charging of battery of specified rating. Charger shall have auto manual operation mode and suitable for 415 V, 3 phase, 4 wire system. Battery charger rectifier shall be Silicon control bridge full wave type. Output voltage regulation shall be +/- 1% maximum from no load to full load. Ripple voltage shall be 3% of RMS voltage. Battery charger shall have following indications AC supply on FC, AC supply on FCBC, charger on FC, charger on FCBC, FCBC on float charging, FCBC on boost charging, Phase fail and battery reverse polarity.

Following meters shall be provided. AC input V meter, DC V meter with selector switch, DC V meter and DC ammeter on load side, DC ammeter FC, DC ammeter battery.

Following annunciation shall be provided, FC fail, FCBC fail, DC voltage low, DC voltage high, overload FC, overload FCBC, mains failure, and battery earth fault and rectifier failure.

DC distribution panel shall be integral part of battery charger with following feeders: One number incoming feeder of adequate rating and 12 numbers outgoing feeders for supply of 110 V DC to various control panels.

t) DC motor starter panel

Panel shall be metal enclosed, wall mounting type, dust and vermin proof, panel shall consist of 2 step resistant starter suitable for 110 V DC supply, + 10% variation. Suitable for continuous duty. Starter shall be so design to limit the starting current two times full load current of DC motor. Panel shall have all necessary meters, contactor, indications and relays.

4.2 Power Distribution

a) 11 KV distribution panel (HT PCC)

One number 11 KV distribution panel shall be provided for feeding emergency load (1.25 MVA) , milling drive load (2 x 1.25 MVA), feeder for power house LT PCC, (3.0 MVA) One feeder for the fibrizor motor (11 KV) + 1 No. export feeder of 630 AMPS & one no. spare feeder .

All other feeder shall be VCB of 400 amp. The panel shall also consist of one generator incoming panel 800 A and power export feeder of 630 amp . (SF6).

The switch gear panels shall be metal clad, free floor standing, totally enclosed, dust & vermin proof, drawout type, vacuum / SF6 breaker .Each breaker shall have distinct positions for service, test, isolation mode and shall have independent earth switch for earthing cable side terminals.

The switch gear shall be with necessary CTs and PTs for metering and interconnection feeder for the existing bus.

Each feeder shall be provided o / c relay, e / f relay, ameter, voltmeter, p f. meter and energy meter etc.

b) 11 KV/415 V distribution transformers for plant load/distillery

Type	Out-door
Quantity	3 nos
Rating	1 x 3.0 MVA (Plant), 1 x 1.50 MVA (Distillery) + standby
Winding material	Copper electrolytic
Frequency	50 +/_ 3 % Hz
H V Connection	Delta
LV Connection	Star
Vector group	Dyn 11
Tapping on HV side	In steps of 2.5 %
Temp. Rise	50 / 55 deg

Each distribution transformers shall be locate in respective sections i.e boiling house , power house & distillery .The detailed specifications are :

The transformers shall be complete with switch-gear , relay protection panel complete in all respects .Transformer shall be outdoor type, ground/platform mounting, oil immersed naturally cooled type (ONAN) , Core type (Copper), double wound as per IS 2026 of 3.0 MVA & 1.50 MVA rating. Suitable for 11 KV/415 V, 3 phases, HV delta connection and LV star connection with copper windings with vector group Dyn11. Transformer shall have HV terminal box suitable for terminating XLPE cables and LV terminal box suitable for bus bar ducting / cable connection. Additional neutral will be brought out for earthing purpose for cable box/bus ducting arrangement. On HV side tapings on HV winding +/- 10% @ 2.5 % shall be provided to maintain rated voltage on LV for constant KVA for HV variation. Tabs can be changed ON-OFF circuit with an external handle. Tab position indicators with locking arrangement on each step shall be provided.

Transformer shall have following standard fittings:

Monogram plate, Conservator with sump & drain plug, Oil filling hole with flange & bolted cover, Prismatic Oil Level Gauge, Dehydrating Silica get Breather with oil seal, Thermometer pocket, Air Release plug, Inspection Cover, Lifting Lugs, Cover lifting Lugs, Jacking Lugs, Top Filter valve 32 mm , Drain cum Filter valve 32 mm, Earthing Boss, Off circuit switch, Storage & instruction plate, Skid type under base & Bi-

directional plain Rollers .Transformer shall have following accessories: Top oil temperature indicator (Vapor pressure type) – Capillary tubing type with MRP/RSD and alarm and tip contacts, Double float Buchholz relay with alarm and trip contracts, Magnetic oil level gauge with low oil level alarm, winding temperature indicator with current transformer and heater coil, and alarm and trip contacts, marshalling box duly wired up from accessories to the box, Radiator shut off valves, pressure relief device.

c) 11 KV/ 415 V / 415 V inverter duty transformers for 12 pulse Mill drives

Type	Out-door
Quantity	3 Nos
Rating	Continuous, 1.25 MVA each
Primary voltage	11KV +/- 10 % (winding delta connected)
Secondary Voltage	415 V / 415 V (winding delta / star connected)
Impedance	5.95 %
Vector	D doy 11

The transformer shall be complete with fittings & accessories like conservator , OG , BREATHER , Bucholtz relay , with contacts etc for alarm & trips , pressure relief devices, thermometer packets ,OTI & WTI , Valves , earthing terminals , cooling accessories , bidirectional flanged rollers with locking & bolting device for mounting on rails , air release devices , inspection box , marshall box etc.

Each transformer feeder shall have incoming supply 11 kv VCB, kw meter, kw h meter an ammeter, instantaneous o/c relay, earth fault relays , ID MT over-current relay .

d) Bus Trunking:

The bus bar shall be made of electric grade (Copper or HT power cable. The bus bar trunking enclosure shall be fabricated out of 50 x 50 x 6 mm angle and folded covers of 2 mm thick aluminium sheets shall be provided on all four sides. The louvers shall be provided on side covers. The flexible copper connections as alternator ends and fixed connections at the breaker panel end shall be provided. The bus bar trunking/cables shall be designed for 6875 KVA continuous capacity at 0.8 power factor at an ambient temperature of 50ºC. and the maximum temperature of the bus bar shall not exceed 85ºC. It shall be designed to withstand a symmetrical short Circuit current of 50 KA (RMS) for one second. The bus trunking/cables shall also have a neutral bus bar of half the size of the phase bus.

e) 415 V Main Distribution Board (LT PCC) – Power house / Boiling house

Two numbers LT Main Distribution Boards (One in the power house & one in the boiling house) shall be provided. The panel shall be fabricated from 14 SWG cold rolled sheet steel and shall be totally enclosed floor mounting type, dust, damp and vermin proof. Louvers shall be provided in the panel for air circulation.

The panel shall be designed for an ambient temperature of 50 deg.C. and the maximum operating temperature of the bus bar shall not exceed 85 deg.C .The panel shall be designed to withstand symmetrical short circuit current of 50 KA (RMS) for one second. The operating heights of the panels shall not exceed 2000 mm. The panel doors compartment shall be interlocked in such a way that it shall not be possible to open them when the switch/circuit breaker is in closed on position. The bus bars provided in the panel shall be of aluminum EC-91E grade. The size of the neutral bus bar shall be half of that of phase bus bar. The earth bus bar shall be located at the bottom and shall be continuous throughout the length of the panel. Removable sheet steel gland plates shall be provided at the bottom of the panels for cable entry. The panel shall have

individual air circuit breaker for outgoing feeders for motor control centres. The panel shall also have individual feeders for auxiliary panel, and electric oil pump for turbo set.

One of the main LT panels shall be located in power house shall have the ACB feeders for the cane handling , mill auxiliaries , bagasse handling , TG set auxiliaries etc .

The other main LT panel located in boiling house shall have individual ACB feeders for boiling house MCC'S , injection pump , spray pump , centrifugal machines (One for batch & other for continuous machine), centrifugal auxiliaries , sugar house etc.

Both of the main LT panels shall have individual ACB incomers (draw-out) of the suitable rating , ammeters , voltmeters , selector switch etc , protection etc . All the outgoing feeders in the main LT panels shall have individual ACB feeders for cane preparation , fibrizor , centrifugal machines & the other feeder shall be with S.F units .

A feeder in both of the main LT panel shall be provided for the installation of 600 KVAR LT capacitors with incoming switch fuse unit , ammeter on indicator , timers etc for automatic corrections.

f) Motor Control Centres (MCC)

Motor Control Centres (MCC) : Complete plant LT load shall be divided into suitable number of zones and each zone shall be connected to separate MCC.

Each MCC shall be provided with 1 No: incoming circuit breaker of 1.2 times the connected load excluding the standby equipment, an ammeter, a voltmeter with selector switch, 3 phase energy meter and OFF and ON indicating lamps. Each MCC will have individual outgoing feeder for each motor connected to that MCC. For squirrel cage motors, each feeder shall have switch fuse unit, starter with over current protection, an ammeter and on indicating lamp. For slipring motors, each feeder shall have switch fuse unit, starter, an ammeter and on indicating lamp. In case of slipring motors rotor starters shall be provided and installed near individual motors.

The MCC's shall also have feeders for connection of low loss power capacitors APP double layer type, each feeder having air break contractor with back up switch fuse unit, on indicating lamps, ammeter, ON-OFF push buttons.

Each feeder in the MCC's shall be housed in separate individual compartments with door interlock.

Each MCC shall be 14 SWG cold rolled sheet steel fabricated cubicle type/cast iron cubicle industrial type, floor mounted, dust, damp and vermin proof. Each MCC shall be expandable at both ends for additions of switches and starter for the motors if required at any stage. The bus bars shall be made of Electric Grade copper. The earth bus bar shall be located at the bottom and shall be continuous throughout the length of each MCC. The operating height of each MCC shall be 1800 mm & maximum height shall be 2300 mm. Control supply of 230 VAC shall be obtained only through Phase & neutral .In centrifugal panels/ MCC 230 V A.C control supply shall be through control transformer.

Each MCC shall be designed to withstand symmetrical short circuit current of 35 KA (RMS) for one second. Each MCC shall be designed for an ambient temperature of 45 deg.C, the bus bar operating temperature at the ultimate capacity of 2500 TCD shall not exceed 85 deg. C. Removable sheet steel gland plates shall be provided in each MCC for cable entry.

Each MCC shall be provided with spare switches, one of each size subject to a maximum of three nos. and a plug with socket of 63 amps. All squirrel cage motors upto

an including of 40 HP rating shall be controlled with D.O.L. starters. All other squirrel cage motors shall be controlled with air break automatic star delta starters.
Each slipring motor shall be controlled with stater / rotor starter installed near motor.

In addition to these MCC's, one pedestal mounted push button operating station (with ON-OFF push buttons) shall be provided near each squirrel cage motor. Also stop push buttons at the ground floor shall also be provided for bagasse elevator, and return bagasse carrier.

g) Electric cables (11 KV, 1.1 KV grade)

Electric cables : All power, control and lighting electric cables for the entire electrical distribution system shall be supplied.

The power electric cables from the main distribution panel to each MCC and to auxiliary panel shall be suitable for the connected load at unity load factor excluding standby equipments. Suitable derating factor for the cables shall be considered as per the recommendations of cable manufacturers.

All power and lighting cables shall be PVC insulated, armoured, suitable for use at 1100 V and shall conform to IS-1554(part I) specifications. All the control cables shall be of copper conductor. The minimum cross sectional area per core shall be 4 mm2 for aluminum conductor and 2.5 mm2 for copper conductor for power cables and 1.5 sq.mm. copper conductors for control cables.

All the power & lighting cables shall be 3. 1/2 core. All other cables from MCC to motors shall be 3 core .

All the cables on the ground shall be laid overhead on proper racks, suitably spaced and clamped to the racks. Separate racks for HT & LT cable shall be provided.

All cable terminations shall be through crimping type cable lugs. Cable glands shall be provided at panels. Starters, motors, push button etc.

h) Auxiliary panels

Auxiliary Panel : The auxiliary panel shall be provided with following outgoing feeders.

1 No: 160 amp switch fuse unit for tube well No: 1
1 No: 160 amp switch fuse unit for tube well No: 2
1 No: 200 amp SF unit for colony supply
1 No: 200 amp SF unit for workshop supply
1 No: 160 amp SF unit for factory lighting
1 No: 160 amp SF unit for street lighting
1 No; 63 amp plug and socket
1 No: 200 amp switch fuse unit for lighting auxiliary buildings
2 Nos: 160 amp switch fuse units as spare

The auxiliary panel shall be with one incoming 1000 amps switch fuse unit. One 1000 amps. 4 pole changeover switch shall also be provided for auxiliary panel so that it can be fed either from the turbo set supply or from the State Electricity grid supply. Neutral bus bar shall also be provided in the auxiliary panel. Other construction details and fault level etc. of the auxiliary panel shall be the same as the main distribution panel. The auxiliary [panel shall be located in the power house. One ammeter with selector switch, one voltmeter and 'ON' indicating lamps shall be provided in the incomer. Each outgoing feeder shall have an ammeter and 'ON' indication.

i) Main lighting distribution board & sub lighting distribution board

One main lighting distribution board and about 12 numbers sub lighting distribution boards for the lighting system fitted with miniature circuit breakers for each circuit shall be provided. The main DB shall be located in the power house The sub-distribution boards shall be evenly spread in the factory area to be illuminated. Each sub-distribution board shall also be fitted with 3 nos. three-pin plug points. The main DB shall have SFU, ammeter with selector switch and voltmeter on incoming feeder, SFU/MCB , an ammeter for 14 nos. outgoing feeders. The wiring for complete lighting system shall be done with the help of PVC insulated and armored aluminum conductor cables run on walls, ceilings or underground trenches as required The lighting boards shall be sheet steel fabricated.

j) Factory lighting

Factory Lighting : The scope of work under this section shall be to provide illumination in main factory building, cane yard, spray pump house / cooling tower with additional two flood lights for illuminating spray pond only, injection water pump house, condenser house, cane preparation house and I.D.fan house. The average illumination levels shall be 50 lux in cane yard, 200 lux in power house and 150 lux in other areas. The lighting system shall be designed for use of fluorescent tubes in combination with HPSV (sodium vapour) / HPMV (mercury vapour) light fixtures.

However, GLS lamps shall be provided on each light glass for various equipments and at each centrifugal machine. All light fixtures and fittings (except tube light, bulb and sodium/mercury lamps) shall be provided.

k) Power Factor Correcting Capacitors and panels

Suitable number and rating low loss power LT capacitors APP double layer type shall be supplied to improve the plant power factor to 0.90, at 1500 TCD crushing capacity. The power capacitors shall conform to IS-2834 specifications. About 600 KVAR capacitors shall be connected to each LT PCC through APFC panel and the balance capacitors shall be connected to the motor control centers and across motors of rating 40 KW and above.

l) Plant earthing

Earthing of all electrical installations shall be done as per IS-3043 specifications and the Indian Electricity Act and its rules and approved by the Electricity Authority of the Government.

m) Evacuation System:

The proposed TG set will be designed to operate satisfactorily in parallel with grid even under high voltage and frequency fluctuation so as to export maximum energy to the grid. It is also very important to safeguard the system during major disturbances like tripping or pulling out of big generation stations and sudden overloading during shifting of the grid loads on the sugar plant's TG set.

At export substation, where the hooking up will be done, the voltage under normal conditions may be varies between 30 KV to 36 KV. In order to maintain voltage variation within limits for the plant's loads, the transformers should be provided with sufficient tapings on higher as well as lower ends to take care of grid voltage variation and transmission system voltage variations due to loading. The sugar factory will be able to

produce surplus power of about 2.85 MW of power (during season) & 4.25 MW of power (during off-season) for export at 33 KV level.

It is proposed to export this surplus power to sub-station through a single circuit line laid on single circuit towers between the plant switchyard and sub-station by extending the 33 KV bus in substation. The exportable power from the plant shall be evacuated by stepping up the power from 11 KV to 33 KV through 11 / 33 KV generator transformers, which is to be located in the outdoor switchyard. This 33 KV switchyard will have single bus arrangement with power transformer and control / protection equipment. The protection, metering and control panels for the switchyard and grid feeder will be accommodated in the plant's central control room. Following major parameters shall also be considered while implementing the cogeneration project:

- The gas type circuit breakers shall be provided in the plant switchyard as well as sub-station for the plant feeder.

- The circuit breaker will be totally re-strike free under all duty conditions and will be capable of breaking magnetizing current of transformer and capacitive current of unloaded overhead lines without causing over voltage of abnormal magnitude.

- The gas of circuit breaker will be suitable for use in the switchgear under the operating conditions.

- Closing coil will be suitable for operation at all values of voltage between 85% and 110% of rated voltage.

- Shunt trip will operate correctly under all operating conditions of circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110%.

- Protection, metering and control relays and meters shall be provided for switchyard and feeder i.e. of sugar mill and sub-station side suitable Nos. of CT's & PT's are to be provided.

- The generator transformer shall have oil & winding temperature relays, magnetic oil level gauge, over current and earth fault relays, differential relay, over voltage relay, restricted earth fault protection at HV side.

- Meters of monitoring the electrical parameters, mimics transducers, annunciators for fault signals and control switches shall be provided in the control panel. Inter locking between breaker, isolators and earth switches for safe operation of the system shall also be ensured class of accuracy for CT's and energy meter shall be as per requirement of RSEB/ RVVNL, but the cost of the transmission line up to sub station shall be born by the seller.

- Lightening arrestors will be provided for transformer, switchyard equipment protection and on terminating ends of the transmission lines. The lightening arrestor will be heavyduty station class type, discharge class III. The arrestors will be complete with insulating base, self contained discharge counters will be complete with insulating base, self contained discharge counters and suitable mili ammeters.

- Galvanized steel base shall be provided in all complete with earth switch. Adequate creepage distance with all isolators shall be maintained. The blades and all operating parts of isolators shall be made of non-rusting material.

- Safety earthing system consisting of buried GI flat conductor earthing conductor to earthing electrodes buried underground.

n) Power Transmission

The nearby 33 KV sub-station is located at about 0.5 km. from the factory site. A power transformer to step up from 11 KV to 33 KV along with necessary switchgear panel and metering system complete in all respect to evacuate 2.85 MW during season & above 4.25 MW during off-season shall be provided. Necessary transmission line from sugar factory to sub-station with switch gear etc. at their sub-station shall be laid by authority (RSEB).

The specification for the power transformers shall be as under:

One No. of transformer to be provided.

Rating	5.5 MVA
Cooling	Gas
Voltage Ratio	11 /33 KV
Highest System Voltage	36 KV
Tap and Range	On load + 10% to 15% in steps of 1.25%
Voltage Vector	YNd1 (To match with grid S/S)
Neutral Earthing	Solid
Impedence	To match with grid S/S transformer)

On load tap change shall meet the requirement of IEC-216.
The generator transformer shall have the arrangement for 11 KV SF6 breaker panel at input and 33 KV SF6 breaker panel at output side for the protection of the transformer, metering etc.

The system shall also consist of lightening arrestors, circuit breaker, battery and battery charger, cables, safety earthing system, lighting in switch yard and power house, lightening protection system, AC auxiliary supply (UPS), DC auxiliary supply, communication system etc .The necessary copper XLPE cable (armoured) : 2 sets each suitable for full load shall be laid undergrDound for interconnection from power house feeder to generator transformer feeder for transmitting power to sugar mill switch yard .

o) Protection, metering & control cubicles

i) The generator transformer will have the following minimum protections, in addition to the in-built protections (Buchholz relay, Oil & winding temperature relays, magnetic oil level gauge), to isolate the equipment during fault conditions:

- ❖ Over current & earth fault relays on HV & LV sides
- ❖ Differential relay
- ❖ Restricted earth fault protection at HV side
- ❖ Over voltage relay

ii) The feeder linking the plant substation and the RSEB sub-station will be protected with directional as well as non-directional over current & earth fault relays. Rate of change of frequency (dF/dt) relay with under frequency protection and vector surge protective relay will also be provided to isolate the generating system during grid disturbances / over loading conditions.

iii) Meters for monitoring the electrical parameters, mimics, transducers, annunciators for fault signals, control switches shall be provided in the control panels, interlocking between breakers / isolators / earth switches for safe operation of the system shall also be ensured.

iv) All the protection, metering & control cubicles and manual and motorized Remote Tap Changer Control (RTCC) panels shall be housed in the plant's common control room. The necessary CT' & PT' for the metering shall be indoor type.

p) Lightning Arrestors

Suitable lightning arrestors will be provided for transformer / switchyard equipment protection and on terminating ends of the transmission lines. The lightning arrester will be heavy duty station class type, discharge class III, conforming to IEC specification 99-6. Arrestors will be complete with Insulating Base, self contained discharge counters and suitable mill ammeters.

q) Isolators & Insulators

i) Isolators complete with earth switch (wherever necessary), galvanized steel base provided with holes, solid core type post insulators with adequate creepage distance conforming to IS:2544, blades made up of non-rusting material, operating mechanism (gang operated, manual/motor charging mechanism) will conform to IS:1818. They will be of center post rotating horizontal double break type and consist of 3 poles. The isolators will have interlocks with circuit breaker and earth switch.

ii) Solid core type post insulators of adequate creepage distances (suitable for very high pollution category) conforming to IS:2544 will be provided for insulation and support in switchyard at plant / grid S.S.

r) Instrument transformers

The instrument transformers and accessories will conform to standards specified below:

i) Current Transformers IS:2704 / IEC:185

ii) Potential Transformers IS:3156 / IEC:186

Instrument transformers will be mounted, sealed porcelain bushings suitable for outdoor service and upright mounting on steel structures. Instrument transformers will be hermetically sealed units with in-built provision to dissipate any excessive pressure build up. Current Transformers will be of ring type with suitable construction at the bottom for bringing out secondary terminals.

4.3 Structures

The structures will be made up of hot-dip galvanized steel and designed to withstand forces during normal conditions (viz. wind loads & dead load of switchyard components) and abnormal conditions (viz. short circuit, earthquake etc.).

4.4 Safety Earthing System

i) A safety earthing system consisting of a buried GI flat conductor earthing grid will be provided for the switchyard. The earthing system will be formed to limit the grid resistance to below 1 ohm. In the switchyard area, the touch potential and step potential will be limited to the safe values. The earthing design will be as per IEEE-80 recommendations and IS: 3043 (Latest addition).

ii) The buried earthing grid will be connected to earthing electrodes buried underground. Neutral point of generator transformer, non-current carrying parts of equipment, lightning arrestors, fence etc. will be earthed rigidly. The following factors will be considered for earthing system design.

- ❖ Magnitude of fault current
- ❖ Duration of fault
- ❖ Soil resistivity
- ❖ Resistivity of surface material
- ❖ Shock duration
- ❖ Material of Earth Conductor, and
- ❖ Earth mat grid geometr

4.5 Cables

i) All cables shall be selected to carry the load current site conditions, with permissible voltage drop. The power cables of 11 KV/1.1 KV grade will be XLPE/PVC insulated, copper conductor (3½ core), inner sheath PVC taped strip / wire armoured with outer sheath of PVC compound conforming to latest version of IS;1554 / IEC:227.

ii) The control cables for control / protection / indication circuit of the various equipment will be of 1.1 KV grade, PVC insulated annealed high conductivity stranded copper conductor, inner sheath PVC taped, flat/round wire armoured with outer sheath of PVC compound conforming to latest version of IS 1554 IEC:227.

4.6 Lightning Protection System

Switchyard equipment will be shielded against direct lightning strokes by providing spikes. The spikes shall be formed to shield all substation equipment with an angle of shield of 30 Deg. / 45 Deg., in accordance with CBIP manuals.

4.7 Safety Regulations

Statutory regulations on safety measures shall be strictly followed. Safety appliances, viz. fire extinguishers, sand buckets, earth rods, gloves, rubber mats, danger boards, safety regulation charts, etc. shall be procured and installed as per safety norms. Oil collection pits and soak pits for the transformers shall also be constructed. All cables in switchyard shall be neatly laid / dressed and shall be barricaded inside trenches along the length with fire proof bricks.

4.8 AC & DC Auxiliary Supply

i) Supplies of single and three phase for illumination, transformer tap-changer drives, breaker / disconnet switch motors, space heaters in cubicles and marshaling kiosks shall be arranged from reliable AC supply source.

ii) DC auxiliary supply required for closing and tripping of circuit breakers, emergency lighting in switchyard will be supplied by the DC system that will be provided for the cogeneration plant emergency / critical loads.

4.9 33KV SF6 type outdoor breaker with necessary metering and protections

Complete switchyard sub-station equipment comprising of SF 6 breaker, outdoor type isolators with and without earth switch, lightning arrestors, CTS & PTS, Post insulators, miscellaneous items i.e. aluminium tubes, clamps, convector, marshelling box, control cables, transformer relay/metering panels on HV side (33 KV side)

Note During the installation of export power equipment i.e. export power transformer and sub-station equipments local electrical authorities shall be consulted for finalization of detailed specifications for matching the grid system. Any equipment if it is not mentioned and required by the electricity authority at Ganganagar Sugar mill is to be supplied & installed without additional cost.

4.10 Diesel Set

2 Nos - One no diesel set of 500 KW for plant load & one no. diesel set of 100 KW for miscellaneous supplementary loads. The diesel generating set shall be continuously rated comprising multiple cylinder diesel engine having necessary protections such as low lube oil pressure trip, high engine temperature trip, over speed trip etc. and shall be fitted with speed control knob speedometer, hour meter battery charging meter, oil pressure and temperature gauges, radiator etc.

The diesel engine shall be coupled with suitable alternator capable of developing continuously the rated power at 3 phase,4 wire, 50 Hz at normal voltage of 420 VAC (Alternator to be suitable for voltage range of 400-440 VAC) and conforming to IS-4722-specifications.

The alternator shall be fitted with minimum one ETD in each phase for thermo protection of the alternator windings. The alternator shall be designed for an ambient temperature of 50deg. C. The alternator shall be self excited and self regulated.

The diesel set shall be complete with base frame, couplings, one M.S. fabricated, diesel service tank of 10 HL capacity, interconnecting piping, D.C. storage battery and self starting mechanism for the engine.

One 2 mm thick cold rolled sheet steel fabricated floor mounted, dust and vermin proof panel for the diesel set shall be provided. The panel shall be fitted with air circuit breaker , an over current relay, over voltage relay, reverse power relay ,reed type frequency meter, earth fault relay, neutral isolating contactor, three phase 4 wire unbalanced energy meters, KW meter, 3 phase power factor meter, 3 nos. ampere meters, one no. voltmeter with selector switch, ON-OFF indicting lamps.

The panel shall have neutral and phase bus bars of electric grade (EC-91E) aluminum and shall be designed to withstand symmetrical short circuit current of 35 KA (RMS) for one second. The panel shall be designed for an ambient temperature of 50 deg.C, the operating temperature of the bus bars shall not exceed 85 deg.C. All the meters shall be class 1.5 per cent accuracy and shall conform to IS-1248- specifications. All the meters shall be square type of 100 mm sq. with 90 per cent deflection Interconnecting electrical cables from the diesel set to the main distribution panel and to the auxiliary panel changeover switch shall be provided. Necessary synchronizing panel with double voltmeter, double frequency meter , selector switch , lamps , synchroscope etc. shall be provided suitable rating bus coupler panel with ACB, cables etc. shall also be provided between the two incomer of the DG sets to run the DG sets in parallel/individually as required. A bus coupler is to be provided to run in parallel or individually.

4.11 Power House Crane

One hand-operated overhead traveling crane of 20 tonnes S.W.L capacity conforming to Class II of I.S specifications complete with bridges , rails etc shall be provided .

5.0 Miscellaneous

5.1 Cane Weigh bridges (refer earlier page)

5.2 Reducing Valves

The following shall be supplied along with the machinery items: -

(i) One automatic steam reducing valve to reduce pressure of 30000 kgs of steam per hour from 72 kg/cm2 to 7-8 kg/cm2 g. pressure with suitable automatic desuper-heating arrangement and regulating system to maintain a steady temperature of 175 deg. plus-minus 5 deg.C. of the reduced pressure steam. There shall be provision for adjusting the down steam pressure at any pre-set valve between 7 to 8 kg/cm2 g the reduced de-superheated steam shall be connected to a receiver with two branches one to supply 5,000 kgs.of steam per hour to centrifugals, sulphur burners, mills, clarification equipment and boiling house etc.

(ii) The second branch shall be provided with one automatic steam reducing valve to maintain a steady pressure of 1.2 - 1.5 kg/cm2 g. in the receiver for exhaust steam from the prime movers by injecting steam upto 25,000 kg/hr, after reducing pressure from 7-8kg/cm2g. Suitable automatic de-superheating arrangement and relating system to be provided to maintain a steady temperature of 130 deg. C. plus-minus 5 deg.C. in the exhaust steam receiver by automatic de-superheating of the entire exhaust and make-up steam and suitable for ultimate capacity. The de-superheated steam coming out of the exhaust steam receiver shall be dry.

There shall be provision for adjusting the pressure in exhaust steam receiver at any pre-set valve between 1.2 to 1.5 kg/cm2 g.

(iii) Two pressure pumps (one standby) with electric drive of suitable capacity with receiver for injecting water in the two reduced pressure steam lines through automatically operated control valves shall be provided for desuperheating.

(iv) All the reducing valves shall be provided with pneumatically/electronically operated pressure controllers designed to maintain steady pressure with down steam flow rate variation from 10% to 100% of the rated capacity with over ridging control system. One electric driven air compressor with receiver and piping shall be provided for in case of pneumatic operation of the reducing valves and de-super heaters.

(v) One steam flow meter shall be provided in the high pressure side of the reducing valve system at (b)(i) above .

(vi) One steam pressure recorder capable of recording pressure upto 2.0 kg/cm2 g. shall be provided in the exhaust steam line near the Evaporator station. A dial thermometer of 200 mm dia and 0-300 deg.C range shall also be provided in the exhaust line. One temperature recorder to record the temperature upto 300 deg.C shall be provided in the exhaust line near the Evaporator station.

(vii) Suitable bypass arrangements as per IBR for each automatic reducing valve to be provided for manual operation. Isolating valves shall be provided to isolate the automatic valve for repairs while working. Steam strainers at

upstream side of each reducing valve shall also be provided. The PRDS be supported on M.S. steel staging.

(viii) Arrangement drawing of PRDS to be got approval from NFCSF.

5.3 Spare Parts.

Critical spares finalize by seller / purchaser / NFCSF, shall be supplied by the seller.

5.4 Necessary Tools & Tackles.

4 sets of necessary tools consisting of spanners, files, screw drivers, testing lamps and tong tester etc. shall be provided by the supplier.

5.5 PERT / CPM/ Bar Chart for Sugar Plant indicating schedule for foundation supply erection & commissioning at ` **XX.**

These chart are enclosed indicating schedule of construction of civil work, supply, erection , trials & commissioning of plant which should be followed by the supplier for commissioning the plant on the schedule date.

6.0 Environmental Management

Adequate environment management systems will be put in place for the treatment of all liquid, solid & gaseous discharges from the sugar complex to achieve the required emission levels well within the permissible limits of state pollution boards.

As a result there shall be no adverse impact on either the air or water quality in and around the sugar complex.

Treatment procedures for the effluent generated from sugar complex is as detailed below.

6.1 Treatment scheme for sugar factory effluent

6.1.1 Screen Chamber

Screening is the first unit operation during the effluent treatment. Screening necessarily involves interception of the coarse solids by means of a bar rack inclined at 45-60 deg. in the flow direction. The screened material to be removed by a manual bar rack.

6.1.2 Oil & Grease Trap

After screening the effluent will enter a Oil & Grease Trap. The floatable free oil & grease shall rise to the surface and removed by means of a mechanical skimmer. The skimmed oil & grease will be collected into an oil trough and disposed off as per requirement.

6.1.3 Aerobic System

Excess condensate after cooling in cooling ponds along with above effluent, from other sources to be sent to a primary clarifier to separate solid by settling. This will improve the performance of aerobic system for aeration to reduce COD & BOD.

Overflow of primary clarifier will be sent to an Aeration Tank operating on the principle of Extended Aeration process. In the aeration tank, an aerobic bacterial culture is

maintained in suspension. The aerobic environment in the tank is achieved through a mechanical surface aerator, which also ensures that the contents remain in a well mixed regime of effluent and aerobic sludge.

After a specified time, the mixture is passed into a Secondary Clarifier, where the cells are separated as sludge from the wastewater. The settled activated sludge is recycled to the Aeration Tank to maintain the desired concentration of MLSS (Mixed Liquor Suspended Solids).

6.1.4 Excess Sludge Disposal & Treatment

The excess activated sludge from the Aerobic system will be taken to Sludge Drying Beds for necessary dewatering. During the drying period, the moisture will evaporate and also filter through the filtering media. The sludge cakes to be used as manure while the filtrate will be taken to Equalization cum Buffer Tank.

6.1.5 Pressure Sand Filtration

Treated effluent from the secondary clarifier will be put to sand filtration to remove all the suspended impurities.

6.1.6 Activated Carbon bed

Filtered effluent will be passed through carbon bed to remove colors and part of the organics.

Treated effluent will be used for irrigation and discharged to the land area. The typical characteristic of treated effluent should meet norms fixed by RSPCB.

6.1.7 RSGSM will prefer **RO Plant** of **Plate & Tube (Pt) Module Membranes** or cost effective essay handling Waste Water treatment system achievable upto the Standard Norms.

6.2 Control for particulate emission

The limit for the particulate matter emission from the bagasse-fired boiler should be as per norms prescribed by RSPCB.

7.0 Instrumentation & Control systems (DCS)

Accurate measurements and control of various process parameters are very important for efficient operations and safety of particular equipments in Sugar Industry & Cogeneration Plant. In a proposed Sugar Plant with Cogeneration, a need based Automation & Control system required to ensure stable & efficient operations of various sections in the Plant i.e. Mill, Boiler, Power House, Water Treatment Plant, PRDS and Boiling House(Clarification, Evaporators & Pan Station).

High ended DCS System & controllers and operating stations should be designed, software development with supervisory control console, inter-connected through Ethernet so that the total information about the Plant can be assessed from any operating station at various sections(Mill, Boiler, Power Turbine, Clarification Section, Pan Station, Evaporator Station, Chief Engineer & Chief Chemist office). However, the Engineering Station & Servers should be centralised with proper redundency in communication and power backup with printer(2 Nos.) with proper and separate earthing in the panels and power back-up. All process parameters of different sections should be with dynamic mimic diagrams.

Provision should be made for centralised online UPS System, 15% extra AOs and AIs and 30% DIs & Dos. All field instruments (transmitters/controllers/ control valves

should be as per standard instrument practice alongwith proper standby for boilers, instruments & control system. Centralised Engineering Station for DCS system should be air-conditioned with proper ducting to maintain the temperature of control room (24 deg.C). The system shall have the capability and facility for expansions through additions of stations, controllers, processors and processor IOs, IDs, AO & *AI* cards and Alarm & Event Display, Alarm Monitoring and Reporting. The supplier of Instruments & Control Systems has to provide trouble shooting & instruction manuals, training to the technical staff of Sugar Mills and will operate & maintain the instrument & control systems in all respects atleast for two seasons free of cost and depute their Engineer, Programmer & Technician during the season for smooth functioning of the Control Systems. If need be, factory may enter into comprehensive AMC after two seasons.

7.1 Milling Section

7.1.1 Cane Carrier Speed Control

Cane carrier speed shall be controlled automatically, based on Donnelly chute level, to ensure uniform feeding of cane to first mill. Primary cane carrier shall follow speed of secondary cane carrier in a fixed ration. Load of all cane preparation devices shall over ride the speed signal of each cane carrier. When load of any cane preparation device exceeds 70% of rated load, speed of that cane carrier shall be automatically proportionately reduced. If load exceed 100% of rated load, that cane carrier will stop. It will restart automatically when load on the cane preparation device fall below 100% of rated load.

7.1.2 Speed Control of Mills

Load on first Mill will be measured and in case load increases above a set value, speed of cane carrier will be reduced to avoid overloading and jamming of first mill. Speed of first mill alongwith chute level will also be monitored and displayed. Normally first mill will run at a predetermined fixed speed. In case of load on mill increases beyond a set value, speed of mill will increase proportionally. Speed will reduce to pre set value after overload is removed.

Speed, load and chute level of other three mills will also be monitored and displayed. Speed of these Mills will be controlled based on set point. Chute level and load on the mill will give overriding signals, so as to ensure optimum loading of the mill under all feeding conditions. The operator will feed in the set point and speed will be controlled depending on load and level feed back signals. Proper inter-locking of all the DC & AC drives, Cane carrier, leveller and fibriser motors for proper safety and reduced jamming.

7.1.3 Imbibition Water Flow Control

Imbibition water flow will be controlled to maintain a fixed ratio of imbibition water to cane. The desired ratio will be fed through the keyboard and the load on the third Mill will be measured. The flow of imbibition water will be regulated to maintain the ratio at various loads. If load of third Mill is below the minimum running load, imbibition water flow will stop. If third mill is bypassed, the system will automatically controlled by second mill load through software program without any extra hardware cost. The level of the tank should also be monitored and controlled through VFD at pump and temperature of the macceration water is to be controlled between 70 – 90 deg.C.

7.2 Boiler Section

Drum Level Control

Drum level control of each boiler will be controlled by three element method. When boiler is running below 30% load, the control loop will automatically switch to single element control based on drum level. When drum level goes beyond these limits, an alarm shall be given to indicate " drum level high" or "low" as the case may be . In case

drum level falls below minimum level, feed water control valve will open fully and " Drum lever very low" alarm will be given. In case drum level rises above maximum level, the feed water valve will open fully and "drum level very high" alary will be given. A standby three element control system for drum level and feed water regulation should be provided which shall respond to the momentary fluctuations of the steam demand upto ± 5% of the rated and CR of boiler in a separate instrument panel consisting of draft guages, drum level pressure, temperature of steam and flue gas.

7.3 Combustion Control

This will be an integrated control loop for maintaining the steam pressure and improving combustion efficiency of boilers. The master controller will measure the steam pressure and speed of variable speed drive for bagasse feeders will be adjusted to maintain the required drive for bagasse feeders will be adjusted to maintain the required amount of primary air. To ensure that this arrangement is correct, the O2 signal from flue gases will be taken in the loop to make final correction to FD fan speed control by VFD, ID fan speed with VFD shall also be controlled to maintain a negative draft of 5 mm water column inside the furnace. Power Cylinders are to be fitted for complete opening and closure of the dampers at ID, FD and SA fans for remote control through DCS Systems.

7.4 Deaerator & HP Heater Pressure & Level Control System

This will be an integrated control loop for maintaining the temperature,pressure and level of the Deaerator and HP heater to maintain the required temperature, level & pressure in the tanks. Deaerator pressure shall be maintained by regulating the steam flow to the deaerator so that temperature of boiler feed water is maintained at the desired set value. Deaerator level shall be controlled so as to balance the inflow and outflow of feed water.

7.5 Steam Temperature Control

Spraying feed water in the super heater system as per manufacturer's recommendations to control superheated steam temperature in close range to avoid any damage to turbine and consistent power output at rated efficiency of turbine.

A Temperature control should be provided through DCS. Following parameters are to be monitored.

Steam & Water flow with totallizer, superheater pressure, temperature of various boiler parameters

a) Super heater steam at final super heater outlet and primary superheater outlet.
b) Feed water economiser inlet.
c) Feed water at economiser outlet.
d) Feed water at deaerator inlet.
e) Flue gas temp. at boiler outlet
f) Flue gas temp. at economiser outlet.
g) Flue gas temp. at air heater outlet.
h) Flue gas temp. at KD fan inlet
i) Air temp. at ID fan inlet
j) Air temp. at air heater outlet
k) Furnace temperature.

Following parameters are to be monitored and controlled through DCS System.

a) Air pollution control device (Electrostative Precipitator)
b) Ash Handling system
c) Condensate and RO Plant.
d) Fuel Feeders for bagasse with variable speed drives, chutes, supports and distributors for fuel (bagasse) feeding into the furnace including silos for bagasse storage above the distributors.
e) HP/LP Dosing system
f) Bagasse Handling system

g) Furnace shooting arrangement.

7.6 Steam Turbine

Following parameters are to be monitored and controlled through DCS System:-

a) Steam Flow at Turbine Control Valve
b) Steam pressure
c) Uncontrolled extraction(pressure & temperature)
d) Controlled pressure extraction
e) Vibration
f) Condensate Operating pressure
g) Inlet temperature
h) Power factor
i) Cooling tower temperature
j) Remote control of cooling tower pumps
k) Hot well control system
l) Condensate water flow monitor with totallizer
m) Uncontrolled extraction steam flow monitor & control
n) Pressure at different stages(oil & steam)
o) Ejector absolute pressure monitor & control

All Gauges and indicators are to be provided in a separate panel near to the turbine with following parameters:

a) Steam Pressure Gauge
b) Steam Temp. gauge
c) Oil pressure gauge
d) Oil temp. gauge
e) Bearing temp. indicator for turbine
f) Bearing temp. indicator for gear box
g) Speedometer at stations.
h) Remote reading tachometer
i) Necessary oil pockets for the inlet live steam/ outlet exhaust steam
j) Steam flow meters
k) All essential tripping circuits to be provided as per turbine design parameters.

7.7 Pressure Reducing & Desuperheating Station

Pressure Reducing & Desuperheating control valves shall be provided for controlling the temperature and pressure of the steam for Boiling House and to gain the additional steam for process. The quantity of live steam to the PRDS should be monitored with flow meter and totallizer.

7.8 Clarification and Evaporation Section

Juice Flow Stablisation Control

Raw Juice from mill house shall be stablized to for consistent flow of juice to process section. The total juice flow to boiling house will be controlled as per a set point based on the raw juice tank level and control with a magnetic mass flow meter and VFD driven pump. This set point will be automatically corrected according to the level in the raw juice tank, to take care of small changes in cane feeding rate. The control logic will be such as to ensure both high level and low level of juice in the tanks and actual set point will operate to maintain the tank level between 30% to 70% flow with flow variation of +/- 1.0% . In case of high or low level in juice tank, alarms will be generated to draw the attention of operator. If level of the tank is above the set point (upper limit), then carrier speed should be reduced and is over rider to all parameters to prevent overflow from the raw juice tank.

7.9 Lime Control

Lime dosing to juice sulphiter shall be automatically controlled based on pre set ratio to juice flow. The total lime slurry will be pumped to an overhead tank and overflow from this will be fed to a lime-proportioning unit. The required amount of lime will be diverted to the process

and rest will be sent back to the lime storage tanks. Lime flow will be measured to give feed back signal to the lime dosing control loop to ensure correct amount of lime is added to juice. In case juice flow reduced below 5% of crushing rate, the lime dosing unit will close 90% to 100% depending on operator set value.

7.10 PH Control

PH of treated juice will be measured and signal given to control speed of sulphur dosing pump of film type sulphur furnace. Combustion temperature of film type burner will be measured and air vent valve will be adjusted to control temp. of sulphur burner.

7.11 Clarifier Juice flow Control

Treated juice flow to clarifier shall be stablised according to a fixed set point for the stable flow to the flash tank and clarifier. This will be achieved with tank, magnetic mass flow meter and VFD on the pump. The tank level will govern the flow output and it will maintain between 30% to 70% level. Alarms will be generated for both high and low level in treated juice tank.

7.12 Evaporator Control

Clear juice flow to evaporators shall be controlled as per fixed set point and adjusted automatically in case level in clear juice tank goes above or below set values. This will be achieved with flow meter and VFD on the pump.Also there will be provision of water connection to wash of the juice on the evaporator tube surfaces and complete the batch pans cycle if any if factory requires shutdown of 8-10 hrs.

Syrup brix at evaporator outlet shall be measured and displayed on the operator station screen and to ensure final brix of above 66% and with limit of 70%. As with steam economy measures, factory steam % cane will be sensitive to evaporator syrup brix and lower value below 64% solid will increase the vapour requirement at pan and also vapour requirement for raw juice heating will decrease.

Vapour Pressure control to work at the designed saturation temp. is essential. Vapour pressure of last effect will be regulated by controlling the flow of vapour to condenser. Also there will be throttle valve between 3^{rd} and 4^{th} effect, 2^{nd} and 3^{rd} effect to ensure vapour pressure in all the effects.

Water flow to condenser of last vessel of evaporator set shall be controlled based on vacuum in last body. Condensate flow from evaporator to boiler section shall be measured and recorded in the operator station, to enable estimation of exhaust steam consumption in the process. Excess Exhaust steam to the Ist body will go to vapour line through control valve. Similarly, the excess inlet vapours of 2^{nd} body will go to 3^{rd} body vapour line and excess of 3^{rd} body will go to 4^{th} body through proper control valves in bypass lines.

7.13 Pan Station

Molasses conditioners

Regulating the steam flow into the vessels will control the temperatures of molasses at outlet of molasses conditioners. Measuring the conductivity of molasses and controlling the water flow control valve will control this brix of molasses at 72% solid is important to maintain the pan vapour consumption as per designed steam balance.

7.14 Vacuum Control

Condenser water flow for each batch pan shall be controlled to maintain its vacuum during the pan boiling cycle.

7.15 Feed Control

Feed of syrup or molasses for all continuous pans based on the conductivity measurement in each cell to ensure boiling supersaturation and existing crystal growth of seed of grain.

Batch pan shall be automatically controlled to maintain desired supersaturating level during pan boiling cycle. Feed of syrup/ molasses shall be controlled based on conductivity measurement of massecuite. The conductivity sensor shall be installed at the same level as the proof stick for proper co-relation between sensor reading and operator's checking.

ANNEXURE II

1.0 GENERAL ENGINEERING SPECIFICATIONS

1.1 ENGINEERING STANDARDS

1.1.1 IS & International Codes

This section of the report gives the basic criteria for the design of the plant. The design parameter, such as sizes, ratings, quantities, material specification, type of equipment etc. described in the report are approximate. Necessary changes could occur on the detailed Purchasing of the plant to achieve the intent of this report to make the scheme successful.

All materials, equipment, workmanship, shop & field test etc. shall conform to the latest Indian Standard Specifications (IS), Indian Boiler Regulations and Codes of Practices as and wherever applicable and other codes as specified. In case recourse is required to be made to any other International Standard, due to non existence of Indian standard or any other reason, the supplier shall specify the same.

Whenever reference is made in the contract to the respective standards and codes in accordance with which goods and materials are to be furnished , and the work is to be performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly set forth in the contract. Differences between the standards must be fully described in writing by the Supplier and submitted to the Purchaser for approval, along with the bid.

In the event the Purchaser determines that such proposed deviations do not ensure equal or higher quality, the Supplier shall comply with the standards and codes set forth in the documents.

1.1.2 Applicable Standards

The minimum acceptable material quality for various components of the plant shall conform to the Indian Standards as summarized hereunder, unless otherwise specified in Technical Specifications. The list must not be treated as comprehensive. For the standards not mentioned in the list, relevant IS or BS should be followed.

No.	Item	Standard Code
1	Gun metal for bearings	IS: 318-1981
2	White metal for bearings	IS: 25-1979
3	Plummer blocks for roller bearings	IS: 4773-2002
4	Phosphorous Bronze casting	IS: 28-1985
5	Specification of wrought Aluminium and Aluminium alloys sheet & strip (for general purpose Purchasing)	IS: 733-1983
6	Shell and tube heat exchangers	IS: 4503-1967
7	Codes of practice for construction in steel	IS: 800-1984
8	Code for unfired pressure vessel	IS: 2825-1969
9	Carbon steel for general Structural purposes	IS: 2062-1999
10	Cast Steel Castings	IS: 2708-1993, IS: 276-2000, IS: 1030-1998, IS: 2856-1999
11	Specifications for alloy steel castings for pressure containing parts suitable for high temperature service.	IS: 3038-1992
12	Forge and carbon steel Shafts	IS: 1570-1979
13	Gun metal valves	IS: 778-1984

No.	Item	Standard Code
14	Steel Globe Valves	IS: 10605-1989
15	Gray Cast Iron	IS: 210 – 1962
16	Cast Iron Flexible coupling	IS: 2693 – 1964
17	Cast Iron Sluice Valve	IS: 2685 – 1971
18	Gear box, worm or helical gear, selection	IS: 7403-1974
19	Method for load rating of worm gears	IS: 7443-2002
20	Insulation	IS: 7413-1981
21	Insulating oils	IS: 335-1993
22	Specification for bonded mineral wool	IS: 8183-1993
23	Mineral wool	IS: 3611-1985
24	Sheet rubber	IS: 638-1979
25	Thermal evaluation and classification of electrical insulation	IS: 1271-1985
26	Industrial application and finishing of thermal insulating materials at temperatures above 80 deg. C and upto 700 deg. C.	IS: 14164-1994
27	Insulating bricks	IS: 2042-1972
28	Brass tube of 70:30 alloy	IS: 407-1981
29	Mild steel pipe	IS: 1239-2004 Part-1 IS: 1239-1992 Part-2 IS: 6392-1998
30	Steel Pipe Flanges	IS: 6392-1971
31	Refractory - high heat duty -moderate heat duty	IS: 8-1994 IS: 6-1983
32	Slide rails for electric motors	IS: 2968-1964
33	3-phase Induction motors	IS: 325-1996
34	Energy efficient electric motors	IS: 12615-2004
35	Motor cooling	IS: 6362-1995
36	Rotating electric machine	IS: 4722-2001
37	Degree of protection provided by enclosures of rotating electrical machinery	IS: 4691-1985
38	On load tap changers	IS: 8468-1977
39	LV fuses	IS: 13703-1993 Part 1- 4
40	Cables	IS: 1554 -1988 Part 1 & 2
41	Cross linked polyethylene insulated PVC sheathed cables	IS: 7098-1993 Part 1- 3
42	Conveyor chains & slats used in sugar industry	IS: 14667-1999
43	Code of recommended practice for conveyor safety	IS: 7155-1994 Part 1 – 8
44	Code of practice for selection and design of belt conveyors	IS: 11592-2000
45	Toughened belt conveyor	IS: 4776-1977
46	Idlers and idler sets for belt conveyors	IS: 8531-1986
47	Alternating current dis-connectors (isolates) and earthing switches	IS: 9921-1985 Part 1-5
48	Lightning Arrestors for AC system	IS: 3070-1993 Part 1-3
49	Practice for the protection of the building and allied structures against lightning – code of practice	IS: 2309-1989
50	Loading guide for oil immersed power transformer	IS: 6600-1972
51	Power transformer	IS: 2026-1994

No.	Item	Standard Code
		Part 1- 5
52	Application guide for Current transformer	IS: 4201-1983
53	Voltage transformer, specification	IS: 3156-1992 Part 1-4
54	Specification for electrical chain hoists	IS: 6547-1972
55	Code of practice for selection, installation & maintenance of switch gear and control gear	IS: 10118-1982 Part 1 – 4
56	LV switch gear and control gear	IS: 13947-1993 Part 1 – 5
57	Low voltage switch gear and control gear assemblies	IS: 8623-1993 Part 1 – 3
58	High voltage alternating current circuit breakers	IS: 13118-1991
59	Plain and reinforced concrete	IS: 456-2000
60	Code of practice for design loads for building structures	IS: 875-1987 Part 1 to Part 5
61	Criterion for earthquake resistant – design of structure	IS: 1893-1984, IS: 1893-2002 Part 1
62	Gantry Cranes	IS: 807-1976 IS: 3177-1999
63	Roller Bearing Plummer Blocks	IS: 4773-2002
64	Specifications for foundation bolts	IS:5624-1993
IEC STANDARDS		
65	Guide for selection of HV cables	IEC 103
66	Static meters	IEC 136
67	Bushing for alternating voltages above 1000 V	IEC 137
68	Deg. of protection of enclosures for low voltage switchgear and control gear	IEC 144
69	Potential transformers	IEC 186
70	Electric relays	IEC 225
71	PVC insulated electric cables	IEC 227
72	Partial discharge requirements	IEC 270
73	AC metal enclosed switchgear and control gear for rated voltages above 1 KV and upto and including 52 KV	IEC 298
74	LVB switchgear and control gears assembly	IEC 439
75	Classification degree of protection	IEC 529
76	Application for power transformer	IEC 606
IEE STANDARDS		
77	Guide for safety in AC sub station grounding	IEEE:80
78	Recommended practice for electric power distribution for industrial plants	IEEE:141
79	Recommended practice for grounding of industrial and commercial power systems	IEEE:142
80	Recommended practice for protection and coordination of industrial and commercial powers of systems	IEEE:242
81	Recommended practice for industrial and commercial power systems analysis	IEEE:399
82	Recommended practice for emergency and standby power for industrial and commercial application	IEEE:446

American society of mechanical purchasers (same)		
1	Rules for construction of power boilers	ASME SECTION I
2	Welding & Brazing Qualification	ASME SECTION IX
3	Undefined precision vessel code	ASME SECTION VIII
4	Welding qualification	ASME SECTION IX
5	Guide for evaluation of measurement un-certainty in performance test of steam turbine	ASME PTC 6.0
6	Safety and relief valves	ASME PTC 25.3
7	Pipe flanges and flanges fittings	ASME B.16.5
8	Butt welding fittings	ASME B.16.9
9	Socket welding and threaded fittings	ASME B.16.11
10	Code for power piping	ASME B.31.1
British Standards		
1	Industrial type metal floors, walk ways and stairways	BS-4592
2	Stairs, ladders and walk ways	BS-5395
	Pipe Flange Drilling	BS : 10-1962
Industrial standards (misc.) Practice in industry		
1	Indian boilers regulation	IBR
2	American gear manufacturers Association	AGMA
3	Structural Welding Code	AWS D1.1
4	Instrument Society of America	ISA
5	National Electrical Manufacturers Association	NEMA
6	National Fire Protection Association	NEPA
7	IEC recommendation Publication No.4S for turbine	CSN – 080030 DIN – 1943
Standard Codes For Testing		
1.	Method for tensile testing of steel products	IS:1608 – 1995
2.	Specification for acceptance standards for ultrasonic inspection of steel castings	IS: 9565 – 1995 IS: 7666 – 1998
3.	Code of procedure for inspection of welds	IS: 822 – 1970
4.	Methods of inspection of spur and helical gears	IS: 7504 – 1995
5.	Bevel gears inspection	IS: 10911 – 1984
6.	Overhead cranes	IS: 807 – 1976
7.	Methods of determination of efficiency of rotating electrical machinery	IS: 4889 – 1968
8.	Measurement and evaluation of vibration of rotating machines	IS: 4729 - 1975
9.	Guide for testing of insulation resistance of rotating machines	IS: 7816 – 1975
10.	Guide for testing synchronous machines	IS: 7132 – 1973
11.	Methods of test for mineral wool thermal insulation materials	IS: 3144 – 1922
12.	Boiler Efficiency, as per ASME publication with its latest amendments, indirect method	PTC 4.1 – 1964
13.	Steam Turbine Performance, as per ASME publication	PTC 6.1 – 1976

2.0 Materials

2.1 Forgings

All shaft forgings above 150 mm diameter shall be subjected to internal examination for the detection of flaws and to heat treatment for the relief of residual stresses.

2.2 Castings

All cast materials shall be as free as is practical of blow holes and flaws. No welding, plugging or filling of any defective parts shall be done without the sanction of the purchaser or his representative.

Heavy steel castings shall be rough machined and then normalized by heat treatment before finish machining.

2.3 Foundation bolts

Foundation bolts, holding down bolts, rag bolts with nuts and washers for all the equipment, structure etc. with grouting pads, covered under the bid, shall be supplied by the Supplier.

2.4 Fasteners

Nuts, bolts and other fasteners employed in the construction of the plant shall conform to the requirements of the appropriate Indian Standards, where applicable.

When fitting on outdoor equipment all bolts, nuts and washers shall be of non-rusting material when in contact with non-ferrous parts.

Where fitted bolts are used there shall be a driving fit into the reamed holes they are to occupy and be marked to ensure correct re-assembly on site. The threaded portion of such bolts shall be of a diameter that shall prevent damage to the thread on assembly.

All nuts, bolts, fasteners required for assembly or mounting of any equipment procured through these documents, including foundation and holding down bolts, are to be included in the supplies.

2.5 Gaskets, Diaphragms

Rubber or rubber-based materials shall not be used for gaskets, diaphragms, etc . Instead, synthetic materials, not subject to deterioration due to climatic conditions shall be employed.

The supplier shall include for supply of all gaskets required for jointing of pipe flanges. Generally specifications of gaskets for different duties shall atleast be equivalent to the following:

1) For 8700 kpa(g), 510ºC steam piping connection, spiral wound flexatallic type gaskets with inner and outer metal rings.

2) For exhaust steam piping, and water piping; wire inserted synthetic red rubber gasket, 3mm thick.

3) For compressed air piping, synthetic red rubber sheet gasket, 3mm thick.

2.6 Conveyor Belting

In the case of conveyor belting this shall also be of synthetic materials of multi-ply construction, with joining ends suitable for Site vulcanizing. The belts shall be supplied initially with mechanical joining material for temporary use for running- in the belts to take out the initial stretch.

2.6 Gear Units

Unless otherwise started in the particular specification, all gear units for reducing or increasing speed of a prime mover, shall be of the totally enclosed type with casing cast in suitable materials and containing gears rated in accordance with Indian Standards.

All gear boxes shall be of min 1.7 service factor (wherever service factor stipulated in Indian Standards is below this value) as per AGMA rating unless stated otherwise.
All gear boxes shall be helical type. Anti-run back device shall be provided for elevators.

The gears shall be mounted on steel shafts running in ball or roller bearings unless otherwise specified.

As applicable to duty the gear case shall incorporate an integral type of anti-runback gear. The gear case, bearings and couplings shall be as detailed in the particular specification.
All gear boxes above 25 hp shall be of helical type. The speed ratio of worm reduction gears shall not be more than 50:1.

3.0 Conveyors And Elevators

3.1 **Belt type Conveyors**

Belt type conveyors for handling bulk material shall be of robust construction with structural frame in accordance with the Indian Standards stated.

Bearings for the troughing and return idlers shall be of the greases packed sealed-for-life type, ball or roller type.

Troughing and return idlers shall be of the heavy duty type.

The conveyors shall be fitted with rotary brush type of cleaners.

All conveyors shall have either a screw type tension unit operating on the tail pulley or a gravity operated unit of the loop pattern placed near to the conveyor drive. The tension carriages shall operate in guides mounted below the conveyor stringers. Take-up shall not be less than 2% of the conveyor length. All belt conveyors shall be provided with screw type adjustment at the tail pulley for tightening and adjustment of the belt.

3.2 Scraper Conveyors

Scraper conveyors shall be of robust construction with structural steel frames in accordance with Indian Standards stated.

Scraper flights shall be constructed of heavy duty steel slat or finger design and fitted with connectors to suite the appropriate chain attachments, unless otherwise specified.

3.3 Screw Conveyors

Conveyors to be either ribbon or full blade scroll type of carbon steel robust construction fitted with tubular shafts, unless otherwise specified. Central bearing is unacceptable.

3.4 Conveyor Structures

The steelwork shall be designed in accordance with Indian Standards, to suit the loadings and environmental conditions.

Care shall be taken in detailing to avoid areas inaccessible for painting and pockets which could catch water.

Construction shall generally be by welding, bolts to be used for Site assembly.

Conveyor stringers shall be of rolled steel angle or channel construction, adequately braced and provided with short supports to ground level or adjacent structures or forming an integral part of bridge steelwork where appropriate.

Decking plates shall be 3.25 mm thick mild steel, unless otherwise specified, bolted in position, flanged as required to give adequate stiffness.

For belt conveyors, where decking plates are provided at feed points only, they shall extend for an adequate distance along the conveyor in the direction of belt travel.

Conveyors which are fully supported along their length by floor steelwork shall be constructed from longitudinal and vertical members forming a framed structure of rolled steel channel and angle section braced as necessary.

Conveyor head and tail frames shall be constructed from rolled steel channel and angle section, all adequately braced.

Screw conveyor trough shall be fabricated from 6 mm thick carbon steel plate with rolled steel angle flanges and end plates shall be 8 mm thick with felt seals and backing plates for the shafts. Cover plates, where required, shall be of flanged construction from carbon steel sheets for bolted or quick release fastening.

4.0 Machinery Staging

4.1 Design and supply

The design, materials, detailing, fabrication and supply of structural steelwork staginess shall comply with the provisions of relevant Indian Standard Specifications, metric units, current at the time of tender, together with the specification therein mentioned, except as otherwise required by the particular specification.

4.2 General Requirement

Except where otherwise authorized, all materials shall comply with the requirements of the particular specification and the relevant Indian Standard as specified.

4.3 New Materials

All materials used throughout the Works shall be new.

4.4 Miscellaneous Materials

All materials not full specified in the particular specification and which may be offered for use in the Plant shall comply with the appropriate Indian Standard and in the absence of such a standard shall be of approved commercial quality.

5.0 Stairways, Ladders, Handrails and Handrail Stanchions

For steel stairways, the treads and landings of stairways shall be open mesh construction. All treads in a flight shall match one with another and also with the line pattern of the landings and, where possible, with the floors served by the stairs.

Toe plates shall be 100 mm high and shall be provided at the edges of all landings, platforms and floors.

Chequred plate flooring is to be “Durbar” non-slip raised pattern or other equal approved gratings. Individual plates are to be cut and fitted so that the pattern or other equal approved, individual plates are to be cut and fitted so that the pattern on adjacent panels matches in all directions. Unless otherwise stated, the plate shall be minimum 5 mm thick on plain and shall be fastened to the steelwork by 6 mm counter sunk set screws at a pitch not exceeding 535 mm centers or by welding. Chequred plate and grating to be galvanized.

Ladders shall be with single rungs, shouldered at each end, inserted into prepared holes in the stringers and welded. The pitch of additional rungs to bridge the gap between the top rung of ladders and edges of platforms shall not exceed 57 mm.

The stringers shall open out at the top of the ladder to allow adequate room for the user to turn to face the ladder when descending and the stringers shall extend a minimum of 1060 mm above the level of the platform. Where necessary the stringers shall be bent over to form a continuous connection with the platform hand railing and at the same height as the top rail.

Stringers shall be attached to the adjacent structure by suitable cleats which shall be firmly attached to the stringers and the supporting structure and be sufficiently close together to make the ladder rigid throughout its length. The cleats shall be of sufficient length to give required clearance at the back of the ladder. The top rung of a ladder shall be at the same level as the floor or edge of the platform unless the flooring of the platform has been extended to form the top rung there shall be no obstructions above this level.

Stairways and floor openings shall have double rail hand railing. Standards, top and bottom railing shall be out of minimum 40, 25 and 20 mm NB pipes respectively. All railing pipes shall be as per IS: 1239 Part I Light or equivalent and galvanized.

The standards shall be vertical and spaced at no more than 1800 mm centers and the top rail shall be 1070 mm above the finished floor or landing level. Standards shall be fixed to the supporting steelwork with a minimum of two 16 mm diameter bolts or welded. Bends in hand railing shall be carefully formed to give satisfactory continuity of curvature and alignment and rails shall be joined with a flush scarf joint held together by means of a tapered pin or other approved joint.

Hand railing for ladders shall meet with the general requirements as above except that the single rail shall be approximately 100 mm clear of the stringer and the standards shall be short single ball type mounted at right angles to the stringer.

6.0 PUMPS

Unless otherwise stated in the particular specification, all centrifugal pumps shall preferably run at speeds not exceeding 1500 RPM. Maximum efficiency of the pumps shall be at 70- 80% rated load.

All pumps shall be manufactured appropriate to its capacity, head and duty in accordance with the relevant Indian Standard. Material of construction to be used generally as follows unless specified.

Impeller	Bronze
Shaft	Stainless Steel
Casing	Cast Steel
Seal	Mechanical

Data for all pumps shall be tabulated indicating the following information:

- Fluid to be pumped
- Type of pump (e.g. split casing centrifugal)
- Rotational speed
- Impeller diameter
- Power consumed and motor size
- Material of construction of

  - Casing
  - Impeller
  - Shaft
  - Neck ring
  - Bushes
  - Quantity of fluid to be pumped
  - NPSH required
  - Total net pumping head from all causes
  - Bearing type and number

For all pumps the following characteristic curves shall be furnished :

- Capacity against head
- Capacity against efficiency
- Capacity against power consumption

All pumps are to be supplied with water sealed packed glands unless otherwise specified. Where fluid being pumped is water this may e fed from the pump discharge into the gland. For pumps pumping hot water, condensate, Supplier shall indicate weather separate gland cooling water is required and its quantity. All centrifugal pumps shall be supplied fully assembled and aligned with electric motor and shall be complete with coupling, common base plate, coupling guard and holding down / foundation bolts. All positive displacement pumps shall be supplied with driving motor, gearbox, couplings, base plate for complete pump with drive assembly coupling guards and holding down and foundation bolts.

7.0 Piping

7.1 General

All piping shall be made of a grade and thickness appropriate to the substance it has to contain its pressure and temperature, and all in accordance with the relevant Indian Standard.

Where steam or vapour piping is fitted to plant, loads due to expansion are to be compensated for by utilizing loops or bends, loop or vertical bend below main line is preferred. Where fitting of bend or loop is not possible then bellows may be used. Material of construction for bellows on steam lines shall be stainless steel.

Gradient of 50 mm in 30 m length of pipe in the direction of steam flow shall be provided on all horizontal pipelines to facilitate drainage.

A maximum pressure drop of 1.2 kg/sq. cm(g) per 100 m pipe length shall be allowed in the pipelines.

Safety valves are to be provided in the steam pipe lines wherever necessary. Safety valves in the exhaust and reduced pressure steam lines shall be lever operated , unless otherwise specified.

Suitable drains, valves, steam trapping arrangement shall be provided in all steam lines wherever necessary. Steam trapping arrangement shall consist of two 20 mm NB globe valves and is down in the sketch enclosed. (This arrangement is referred as Double Valve Steam Trap in the write up). The double valve steam traps shall be provided at all natural drainage points in high pressure, reduced pressure and exhaust steam lines; including bottom of lops, just before risers, below steam separator and ahead of reducing and shut off valves.

7.2 Piping Materials

The piping material selection shall be based as under:

- For temperature above 400^0C to 500^0C, SA 335 Gr. P11/P12/P22.
- For temperature 399^0C and below SA 106 Gr. B/C or ASTM A-53 seamless.
- For HP/LP chemical dosing SA312TP304, stainless steel (SS pipe schedule 10).

All mild steel pipes and pipe fittings used for conveying of air, cold water, hot water except feed water, oil shall conform to IS: 1239-1976 (Part I) and IS:239-1962 (Part II) specifications. The piping shall be Class 'C'. The thickness of the mild steel pipes having diameter more than 200 mm shall be 8mm min.

In case of all piping above 25 mm NB, except for exhaust steam and vapour piping only flanged joints shall be used. All flanges shall conform to IS:6392-1971. The distance between two flanges in straight portion of pipes shall not exceed 6 meters. In case of bends, flanges shall be provided at least on one end. Flanges at ends of pipeline, pipe shall be provided with bolted blind flanges.

7.3 Live steam, Exhaust steam and Vapour piping

These shall conform to IBR, as applicable. The thickness of exhaust steam and vapour piping shall be minimum 8 mm for 300 mm dia and above. All steam expansion bellows shall be of stainless steel tested at 1.5 times the steam pressure.
On high pressure and reduced pressure lines, a branch line shall be taken from the top of main line and not from bottom.

7.4 Valves in piping

Valves shall be provided in each branch line of high pressure, reduced pressure steam lines, water separator, drain etc.

Suction and delivery lines of all pumps, shall be provided with isolating valves.

Delivery lines of all pumps shall be provided with non-return valves. Non-return valve shall be installed between pump delivery flange and isolating valve.

Delivery lines of all pumps shall be provided with by-pass line with valve back to suction source.

7.5 Construction

Where steel pipe work is to be welded it shall be carried out by the electric are process and conform to the relevant Indian Standards. Welding shall only be carried out by suitably qualified welders who shall be required to hold a current welding certificate in accordance with the appropriate Indian Standard.

Procedures for the testing of welders shall also be in accordance with the relevant Indian Standard.

All welded pipe work is preferred on nominal bore 150 mm and above, unless otherwise stated. Intermediate flanges are to be used wherever essential for maintenance, design or transport reasons.

The Supplier shall be responsible for determining locations of Site butt welds to break the piping runs into separate sections for the purposes of transport to Site, and for properly and clearly designating each section for correct Site assembly.

7.6 Preparation for Site Assembly

All pipe work supplied for Site butt welding shall have the ends machined and protected for transportation.

Pre-fabricated piping sections shall be capable of being fitted into place without springing or forcing except where cold pull is required.

The outside surface of the piping shall be painted with one coat of red oxide.

All flanges and nozzles shall be protected with wood or suitable covers and the thread ends greased and protected.

7.7 Flanges and Fasteners

All bolt holes in flanges shall be equally spaced off vertical and horizontal center lines of pipes conforming to BS 10, Table D for all liquids such as water, juice, syrup, magma, molasses, air, oil, exhaust steam and vapour {Exhaust steam and vapour up to 1.6 kg/sq. cm(g)}. For high pressure steam above 1.6 kg/sq. cm (g), the relevant IBR standards shall apply. Orifice plate flanges shall be standard to schedule unless otherwise stated.

Loose flanges and cutting lengths on pipelines shall be supplied to allow for alignment errors in plant location.

All bolts, nuts and washers plus 10% spare shall be supplied by the Supplier.

7.8 Pipe Supports

Piping shall be carried by supports of suitable fabrication to ensure that no undue stresses are placed on adjoining pipe work and equipment.

Piping connected to equipment shall be so supported that minor equipment, valves etc., can be readily removed without additional supports and with a minimum of dismantling.

Anchor sliding, spring, resting, etc. supports shall be provided for those pipe runs demanding this form of fixing and shall be fabricated in accordance with the duty of the pipe.

Flexibility of all high pressure, reduced pressure and exhaust steam piping shall be designed in accordance with IBR.

7.9 Velocities

All hot and cold water, juice, syrup, magma, molasses, massecuite, bled vapours, live steam, reduced pressure and exhaust steam pipe lines, all headers shall be designed for ultimate crushing capacity. Various pipelines shall be designed so that velocities given below are not exceeded at specified crushing rate.

Water and juice	Suction 1.0 m / second Delivery 1.2 m / second
Condensate	Suction 1.0 m / second Delivery 1.25 m / second
Syrup	Suction 0.5 m / second Delivery 1.0 m / second
Molasses	Suction 0.3 m / second Delivery 0.5 m / second
M'cuite / Magma	Suction 0.1 m / second Delivery 0.15 m / second
Superheated & Saturated steam, Exhaust steam, Bled Vapours	30 m / second
Compressed air	20 m / second at 0.5 kg/sq cm g

7.10 Valves

7.10.1 General

All valves shall be of the rising spindle outside screw type.

Valves shall be installed so that any plant item may be isolated from all services and process lines and to allow tanks and vessels to be drained and vented.

Valves shall be supplied in order that standby pumps may be serviced during normal factory operations.

Valves in infrequently used pipelines shall be positioned in such a manner as to avoid piping remaining filled with fluid for prolonged periods of time.

7.10.2 Valve Types

The following is a general guide as to the type of valve required to be used for a particular duty.

Globe Valves

These shall be used on small bore pipelines (up to 50 mm) for such duties as:

Exhaust steam and vapour

Hot water

Wedge or Parallel Slide Gate Valves Shall be used where control of flow is desired by direct hand operation of spindle wheel.

The pipeline duties envisaged for these valves are:

- High pressure steam
- Exhaust steam stop valves at prime movers
- Hot water
- Juice services
- Condensate
- Cold water

Butterfly valves

Where flow of materials is required to be controlled by gear operated spindle wheels or by valve actuators, butterfly valves shall be employed.

General

In addition, special duties shall have valves considered most suitable for those duties. Non-return valves, relief valves, ball float valves, bib nos. test cocks, drain cocks, etc., shall be provided as considered necessary for the efficient functioning of the plant and to facilitate repair work and maintenance.

8.0 Tanks & Vessels

Tanks of a capacity of up to 30 cubic metes of the open top or vented to atmosphere type, shall be rectangular or cylindrical construction as dictated by the particular specification.

These shall be fabricated of mild steel, unless otherwise specified, of a minimum thickness of 6 mm and shall be constructed with all necessary bracing, connection branches and pads, flanged, screwed and tapped as necessary.

Each tank shall be supplied with, or have fitted, the necessary fittings such as manhole cover, internal and external vertical caged ladders, peripheral roof handrail as necessary.

9.0 Insulation

These Specifications cover the general requirements for insulation work. The Supplier shall refer to the relevant IS for selection, inspection and application of the insulation with aluminium cladid . In case of doubt, clarification may be sought from the ‘Purchaser’. The supplier shall supply all material, consumables, labour, tools and equipment of the Plant necessary for executing the insulation work.

9.1 Insulation Material

Insulating material such as glass wool or mineral wool shall be selected depending upon the temperature of the fluid / steam. Calcium silicate (Hysil blocks) which is chemical compound of lime and silica along with mineral fibre are used as second layer behind the refractory for effective internal insulation. The supplier shall supply insulating materials for the Work as specified in the relevant IS or described as under, whichever thicknesses are higher.

- Mineral wool in thickness specified below
- Glass wool blanket, 75 mm thick

- ❖ Galvanized chicken wire Honey comb mesh, 22 SWG
- ❖ Galvanized steel wire 18 SWG for equipment of the plant, and 20 SWG for piping
- ❖ Insulating cement
- ❖ Aluminium sheet metal for cladding 20 SWG
- ❖ Cadmium plated sheet metal screws for cladding on steam turbines
- ❖ Black washers for attaching binding wire to vessels

All exposed portions which operate at temperatures greater than 60^0C will be provided with insulation.

Major portion of the boiler exposed to outside are insulated with Lightly Resin Bonded (LRB) mineral wool. For insulation thickness of more than 75 mm, two or more layers of mattress will be used and each layer will be backed up with galvanized steel wire netting. Mineral wool mattress confirming IS 8183 is used. Thermal conductivity of mineral mattress will be as per IS 3346. The density of insulation for temperature up to and including 400^0C shall be 100 kg/m³ and above 400^0C shall be 120 kg/m³. All insulated surface will be covered by an outer covering (cladding) of Aluminium sheet. All insulating sheeting joint shall be sealed and made effectively weather and water proof.

Perfect leak tight arrangement of sealing will be provided at furnace roof where superheater tube penetrates.

Tentative details of insulation used for various boiler components is given below:

Drum	100 thk. LRB mattress in two layers covered with 0.7 mm thk. Aluminium sheet
Furnace	100 thk. LRB mattress in two layers covered with 0.7 mm thk. Aluminium sheet
Boiler tank	100 thk. LRB mattress in two layers covered with 0.7 mm thk. Aluminium sheet
Boiler bank to forced flow	150/100 thk. LRB mattress in two layers covered with 0.6 mm. thk. Plain Aluminium sheet
Forced flow section to air heater	100/80 thk. LRB mattress in two layers covered with 0.6 mm thk. Plain Aluminium sheet
Gas duct from AH to Chimney	60 thk. LRB mattress covered with 0.6 mm thk. Plain Aluminium sheet.
Furnace headers	100 thk. LRB mattress in two layers covered with 0.6 mm thk. Plain Aluminium sheet.
SH Headers	100 thk. LRB mattress in two layers covered with 0.6 mm thk. Plain Aluminium sheet
FFS Headers	60 thk. LRB mattress covered with 0.6 mm thk. Plain Aluminium sheet
All other piping / equipment	As required

9.2 Insulation of piping

Pipe insulation more than 75 mm shall be installed in multiple layers with joints staggered around the circumference.

All fittings including valves and flanges shall be insulated. Provide clearance for removal of flange bolts. After insulating valves or other piping specialty, wrap flange with Aluminium sheet and insulate the joint.

Pipelines shall not be insulated before the system is hydraulically tested and approved by the Purchaser.

Molded insulation shall be secured to the pipe with binding wire.

When insulation mat is split and wrapped around the pipe, joints shall be painted with insulating cement to form a smooth, neat surface.

Insulation for valves and other piping specialties shall be securely wrapped with chicken wire and coated with insulating cement.

Piping systems shall be clad with Aluminium sheets fastened by sheet metal screws. On horizontal pipe runs, the joints of the cladding shall be at the bottom of the pipe.

9.3 Insulation of equipment

Glass wool blankets shall be cut and fitted to the contours of the equipment and secured to chicken wire mesh so that each insulating pad can be removed and reinstalled.

Fabricate sheet metal housing in sections and secure with sheet metal screws. The housing shall be designed so that it is sturdy and can easily be removed and replaced.

9.4 Insulation of Vessels

Hooks, rolled angles, flats are to be welded to the equipment of the Plant being insulated, for securing and supporting the insulating material and Aluminium cladding.

Washers are to be welded to the vessel surface to attach binding wire used to secure insulating material to vessel.

Install blanket insulation and secure with binding wire.

Aluminium sheet cladding is to be installed over the insulating material and secured to supports with sheet metal screws. The cladding shall be designed and installed so that the joints are watertight.

9.5 Insulating Material Thickness

The following table indicates the minimum thickness of insulating material Mineral wool of 120-125 kg/cum density, for piping, vessels and equipment of the plant.

Insulation thickness is in millimeters and temperature in ^{0}C.

Pipe Dia (mm)	Temperature								
	65 to 120	121 to 148	149 to 203	204 to 259	260 to 314	315 to 370	371 to 425	426 to 481	482 to 537
12	25	25	25	30	30	40	40	50	50
20	25	25	30	30	40	50	50	50	50
25	25	25	30	30	50	50	50	50	62.5
40	25	25	30	40	50	50	62.5	62.5	62.5
50	25	25	30	40	50	50	62.5	62.5	62.5
75	25	30	40	45	50	62.5	62.5	75	75
100	25	30	45	45	62.5	62.5	62.5	75	87.5
150	25	40	50	50	62.5	62.5	75	87.5	87.5
200	40	50	50	50	62.5	75	87.5	100	100

250	40	50	62.5	62.5	75	75	87.5	100	100
300	40	50	62.5	62.5	87.5	87.5	100	100	125
Surfaces	50	62.5	75	75	87.5	100	100	150	200

10.0 Electrical System

10.1 System Parameters

Voltages used shall be as below:

Low tension	415	V	3 ph	50 Hz
Welding supplies	415	V	3 ph	50 Hz
Lighting	415/220	V	1 ph	50 Hz
Socket outlets	220	V	1 ph	50 Hz
Anti-condensation heaters	220	V	1 ph	50 Hz
Portable tool transformers	220/110	V	1 ph	50 Hz
Hand lamp transformers	220/25	V	1 ph	50 Hz
Control circuits	110	V	1 ph	50 Hz
Instrument supplies	110	V	1 ph	
Emergency lighting	110	V	DC	
Tripping supplies	30	V	DC	

10.2 Electric Motors

Unless otherwise stated in the particular specification, all motors within the factory buildings shall be of the totally enclosed fan cooled type. All motors above 25 bhp shall be of energy efficient type.

- Motor bearings shall be of ball and/or roller type each fitted with oil or grease lubricators. Small motors can have sealed bearings.
- Provision shall be made at one shaft end for a tachometer to be inserted to check the motor speed.
- The motor winding ends shall be brought out to terminal boxes to enable phase tests to be made and for interchanging phases without disturbance to any sealing compound.
- Motors shall be to IP 54 protection and insulation Class F. Temperature rise shall be limited to class B. An earthing terminal shall be fitted to the stator frame.
- Terminal box shall be located either on left or right side of the motor and shall be rotatable in steps of 90^0 to facilitate cable entry from any direction.
- Space heaters are to be provided for all motors above 112 kW rating. Terminals of the space heaters are to be located in the main terminal box and are to be covered with an insulated shroud.
- Squirrel cage motors are required unless otherwise specified. Reasons shall be stated for any deviation from this type of machine.

10.3 Cabling and Wiring

Scope of Supply

Supply of power and control cables is included from the scope of this tender unless otherwise specified.

10.4 Motor Starters

MCCs shall be supplied by others and shall be fitted with the necessary starters and protection switchgear for the motors included in this tender. The Supplier is required to quote for all the Starters of motors.

11.0 Instruments

11.1 Signals

Electronic range of instruments shall be standardized on 4 to 20 mA signals, receiving instruments for control and recording purposes accepting 1.0 volts, DC to 5.0 volts DC. The pneumatic range shall utilize signals of 0.2 to 1 kg/sq. cm (g).

11.2 General Construction and Supply

Unless otherwise specified, all indicating and recording instruments shall be flush mounting pattern with dust and moisture proof covers. Scale shall be of such material that no discolourisation or peeling takes place with age under humid tropical conditions.

The movements of all electrically operated instruments shall be of the dead beat type and provided wherever necessary with an accessible zero adjustment. Where appropriate normal and other operating points shall be marked on the scale face.

All electrical instruments and meters shall comply with Indian Standards and unless otherwise specified shall be of industrial grade accuracy.

Meters shall be calibrated to the appropriate grade in Indian Standards with due allowance being made for the errors in the associated instrument transformers.
Calibration of all instruments shall be in the units of measurement specified in these documents.
Temperature measurement for temperatures above 150 ^{0}C shall be of the thermocouple type and below 150 ^{0} C of resistance type.

Pressure gauges shall comply with requirements of Indian Standards. Stop cocks shall be fitted adjacent to each pressure gauge and isolating valves included where pressure

gauge piping is connected with the main system.
On-plant instruments and gauges are to be locally mounted and fitted in robust cases.

11.3 Instrumentation & Control

11.3.1 General Specification

Information To Be Furnished by Seller :

The seller shall furnish the following documents along with the Bid:

Complete bill of material of instruments/equipment and accessories with their particulars.

System architecture

Technical literature of all instruments and control system.

Dimensional drawings of the panels/cubicles.

Load burden of each system/subsystem furnished by Seller to be fed by UPS and DC sources with inrush current details and heat load for each cubicle/system cabinet/panel section.

Grounding scheme to be adopted for the entire system and sub system.

Complete power distribution scheme both AC and DC of the system.

Schedule of Design, Manufacture, Erection, Testing and Commissioning to project schedule along with PERT network/chart.

All other data, drawings and documents specifically called for in various sections of the specification.

11.3.2 Design Criteria

All equipment/systems and accessories furnished as per this specification shall be from the latest proven product range of a qualified manufacturer. The Seller shall furnish satisfactory evidence regarding successful operation and high reliability of the proposed equipment/systems in sugar mills.

When more than one device uses the same measurement or control signal, the system shall be arranged so that the failure of any recorder, indicator or control component shall not open the signal loop nor cause the loss or malfunction of signal to other devices using the same basic signal. The design shall permit the removal from service any indicating, recording or control devices without causing any disturbance or requiring re-adjustment in other measurement/control loops using the same signal.

11.3.3 Power Supply And Air Supply

a) Power Supply

The normal voltage, phase, frequency and percentage variations at which power supply feeders shall be provided by the purchaser are as follows :

Voltage	415V $\pm$10%
Frequency	50 HZ $\pm$5%
Phases	3

b) Air Supply

The seller shall supply instrument air as elaborated below.

Clean, dry, oil free instrument Quality air of the following quality shall be provided for various pneumatic control devices & accessories:-

Nominal pressure	7 kg/cm² gauge
Range of pressure	3.5 to 8.5 kg/cm²(g)
Dew point	+2 °C at the above pressure. 40 °C at NTP
Maximum particle size	5 microns

Pneumatically operated equipment offered by the Seller shall be designed to operate with the above air supply and adequately cater to their respective duty within the full range of pressure variation.

11.3.4 Choice of Hardware

The primary objective for the design of instrumentation and control systems shall be to assist in the attainment of maximum unit availability.

11.3.5 Design of Enclosures

Design of enclosures shall be in conformance to the requirements of NEMA ICS-6-110 and shall take into account the environmental conditions well as the maximum permissible temperature rise of 10 ^{0}C inside the enclosures.

Instruments mounted in air conditioned areas will be provided with dust tight drip proof enclosures (NEMA-12).

Instruments mounted indoors will be provided with water tight enclosures (NEMA-4) or dust tight, drip proof enclosures (NEMA-12) as required for the particular location. Instruments mounted outdoors will be provided with water tight enclosures (NEMA 4).

11.3.6 Special Tools and Tackles, Special Calibration Instruments :

Seller must offer special tools & tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the plant.

11.3.7 Interface with Owner Furnished Equipment/Systems

The Seller shall furnish necessary interface equipment required for satisfactory operation of equipment furnished by the Seller with Owner's existing equipment. The Seller shall fully meet all the interface requirements with existing control systems, switchgear & motor control centers etc.

11.3.8 Codes and Standards

11.3.9 Reference Codes and Standards

The design, manufacture, inspection, testing, site calibration and installation of all equipments, system and service covered under this specification shall comply with the requirements of the latest statutes regulations and safety codes as applicable in the locality where the equipments/systems will be installed. The Seller shall fully acquaint himself with these requirements and shall ensure compliance with them and also mention IS codes of other relevant codes for equipments not mentioned here and supply accordingly.

All equipment and systems covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable ANSI, ASME, IEEE, NEC, NEMA, ISA, DIN, VDE and Indian Standards and their equivalents.

12.0 Electronic measuring Instruments & Control hardware

12.1 Standards

1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973)

2. Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5 - 1974.

3. Compatibility of analog signals for electronic industrial process instruments - ISA-S 50.1: ANSI MC 12.1 - 1975.

4. Dynamic response testing of process control instrumentation - ANSI MC 4.1 (1975): ISA-S26 (1968).

5. Surge withstand capability (SWC) tests - ANSI C 37.90a (1974) IEEE Std. 472 (1974). IEC - 254.1.

6. Dimensions of attachment plugs & receptacles ANSI C73-1973.

12.2 Instrument Switches and Contacts

1. Contact rating - AC services NEMA ICS Part-2 125, A600

2. Contact rating - DC services NEMA ICS Part-2-125, N600.

Enclosures

1. Types of enclosures - NEMA Std. ICS-6-110.15 through 110.22 (Type 4 to 13).

2. Racks, panels, and associated equipment - EIA: RS-310-B (ANSI C83.9 - 1972)

3. Protection Class for Enclosure, Cabinets, Control Panels and Desks - IS-2147-1962.

12.3 Sampling System

1. Stainless steel material of tubing and valves for sampling system - ASTM A269-82 Gr TP316.

2. Submerged helical coil heat exchangers for sample coolers ASTMD 11-92-1964.

3. Water and Steam in power cycle - ASME PTC 19.11.

4. Standard methods of sampling system - ASTM D 1066-69.

12.4 Annunciators

1. Specifications and guides for the use of general purpose annunciators - ISA RP 19.1-1979.

12.5 Interlocks, Protections

1. Relays and relay system associated with electric power apparatus - IEEE std.3.13.

2. Surge withstand capability tests - ANSI C37.90a - 1974 and IEEE Std. 472 - 1974.

3. General requirements & tests for switching devices for control and auxiliary ircuits including contactor relays - IS-6875 (Part-I) 1973.

4. Turbine water damage prevention - ASME - TDP-1980.

5. Boiler safety interlocks - NFPA Section 85B, 85D, 85E, 85F,85G.

12.6 Electrical Noise Control

The equipment furnished by the Seller shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Seller's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems.

12.7 Surge-Protection For Solid State/Micro Processor Based Equipment

All solid-state equipment shall be able to withstand the noise and surges inherent in a sugar factory & power house. The equipment shall be designed to successfully withstand without damage to components and/or wiring, application of surge withstand capability (SWC) wave whose shape and characteristics are defined in ANSI publication C37.90a - 1974 entitled "Guide for surge withstand capability (SWC) Tests".

13.0 Distributed Integrated Control System

Distributed Integrated Control System (DICS) includes Regulating Controls, Interlocking and Protection, Sequential Controls, Operator Interface Units, Monitoring and Information data archiving, Historical data storage and retrieval, Trending, Alarms & Reports.

Seller shall offer latest system available with him & shall also confirm that DICS system hardware / software shall be upgraded free of cost, for hardware upto commissioning of the project and software upto 3 years after commissioning of the project.

The DICS shall receive process signals from field sensors & transmitters and shall give commands to final control elements, alarms, trip relays, etc. All signal converters, to convert sensor signals to standard 4 to 20 mA signals shall be included in Seller’s scope of supply.

High ended DCS System with stand by communication redundancy should be placed at Mill house, Clarification & Evaporation section, Pan Boiling section and Boiler/Power generation section in air-conditioned control room with air curtains at doors to maintain the temperature of 27 deg.C.

13.1 Introduction and General Requirement

Distributed Integrated Control System (DICS) shall comprise of the following sub systems operating in completely integrated manner employing the same family of hardware and software.

i) Processor stations/sub system:- where function of closed loop control system (CLCS), open loop control system (OLCS) and Measurement (Including Signal Acquisition, Conditioning, Distribution, Transmission, Indication and Recording) are realised.
ii) Operator Station/sub system:- which together with their branded computers, monitors other peripherals perform operation and monitoring functions including data archiving & alarm monitoring etc as per purchaser’s choice.

iii) Programming, and on line diagnostic station (Maintenance Purchasers Station):- for system programming, system configuration, system and instrument failure detection and trouble shooting.

iv) Communication Network: The system shall be distributed and various sub-systems shall be integrated through a system of communication on Ethernet network. The man machine interface between the operator and plant shall be through flat screen monitors, key board and mouse.

v) Field Instruments: All process sensors & transmitters shall be provided for sensing process parameters. Sensor & transmitters for main process parameters shall be of smart type with local display and ability to be monitored /re-calibrated from the Control station.

13.2 Basic Features/Design Requirements

13.2.1 Design Requirements

1 The instrumentation and controls shall be designed for maximum availability, reliability, operability and maintainability

2 All I&C equipment shall be designed for their specific application within the sugar mill and shall be furnished for required control, protection, alarm and remote monitoring. The application and selection of these I&C equipment including signal converters, interposing relays, microprocessors, etc. shall be the responsibility of I&C Seller.

3 All I&C equipment furnished must have proven experience of working in the sugar factories, at least two sets of such equipment installed in a similar sugar factory have been running successfully for at least two years. No prototype components shall be used.

4 DICS shall be of latest design, not be more than 3 year old. The control system shall be highly modular and arranged to reflect the grouping of plant equipment and systems to be controlled.

5 Any local junction termination boxes or auxiliaries which are required to implement the interface design shall be supplied by I&C Seller.

6 Control system shall comply with following general failure criteria :

a No single fault can cause the complete failure of the control system.

b The grouping of control functions into system blocks shall be arranged such that failure of any one block will only partly degrade the control of the overall system.

7 To meet the above failure criteria the I&C system shall incorporate self- checking facilities so that internal faults can be detected within the system itself.

8 Alarms shall be provided for all abnormal conditions of the process.

9 The following colors shall be selected for equipment status indications:

Green	Energized, Running, Valve Open
Red	De-energized, Stopped, Valve Closed
Light yellow	Abnormal condition, Discrepancy
White	Control Power Available

10 The DC and AC power of each control and monitoring system shall be derived from two independent sources and float charged batteries shall be furnished to guard against the total loss of power supply.

The system shall be provided with extensive diagnostic features so that a system failure can be diagnosed down to the module level giving location and nature of fault. Ease of maintenance and trouble-shooting shall be a primary consideration in equipment selection.

The offered system shall have windowing capability with atleast splitting up one screen into four different sections to monitor four different areas/information face plates in the same screen.

13.2.2 System Architecture

The operating station and Engineering station shall be connected on open network, either on Ethernet TCP/IP or Control net in order to make the system open. All operating stations shall be interchangeable and operation of the plant shall be possible from Purchasing station if required.

The system shall have built in redundancies for all system functions at the processor. No failure of any single network shall lead to any system function being lost. It shall have redundant open type network on a "masterless" principle.

The system shall have the capability and facility for expansion through addition of station/ drops, controllers, processors, process I/O cards etc.

The application programs for the functional controllers shall reside in EEPROMS or in non volatile *RAMS. The application program shall be alterable by access through programmer's console.*

13.2.3 Main Controller Characteristics

Each controller envisaged for this project shall have following features as minimum:

i) Processing length of 32 bit
ii) Watch Dog timer
iii) Memory protection
iv) Self monitoring & diagnostic feature
v) Easy modification of control functions

13.2.4 Processor System (Automation System)

The analogue/binary input/output modules, drive control module for analogue control/open loop control, function group control module etc. shall form part of the Process Station. The control system should not have more than ten different types of modules. The system with reduced number of different types of modules/cards has the advantage of easier servicing, modification, reduced spare inventory & hence the same shall be preferred.

13.2.5 Analogue Input/Output Modules

Analogue input/output modules shall be capable of accepting TC&RTD (Universal Card), 4-20 mA current.

It shall have the following features:-

a) High accuracy of conversion, minimum 12 bits, plus sign bit.
b) Linearisation and error checking of TC and RTD signals and reference junction temperature correction facilities for T/C.
c) All the inputs shall be isolated to 600V.

13.2.6 Binary Input/Output Modules

The Binary signal conditioning processing shall be performed in distinct binary input modules which can accept voltage free contacts, digital signals, and also pulse inputs. The modules shall process different inputs such as volt free contacts, proximity switches and logic signals.

The binary input/output modules shall have the following features:-

i) High insensibility against noises and other disturbance.
ii) High insensibility against over voltage (IEC-255-4 Class-II).
iii) Supply of contacts voltages - with 24 V DC
iv) Signal status indicators by LED's on the module front
v) All the inputs shall be isolated to 600V between any input point and ground or between any pair of inputs & shall comply with ANSI 37.90a for transient surge protection to 2000 volts.
vi) For Pulse Inputs provision shall be made to receive and accumulate pulse inputs in the form of repetitive contact closures.

13.2.7 Close Loop Control Functions

The following control algorithms shall be possible as a minimum in respective processors:

i) P, PI, PID
ii) Square root
iii) Addition/Subtraction
iv) Linearisation
v) Multiply/divide
vi) Ratio (Scale)
vii) High/Low signal selectors
viii) Totalizers
ix) Manual loading
x) Lead-lag compensation
xi) Feed forward controller
xii) Over ride
xiii) Multivariable control
xiv) Nonlinear control algorithms
xv) Biasing
xvi) Mean (average)
xvii) Median value selection - analog
xviii) Two out of three logic - digital

Open Loop Control Function

Functional group control module for open loop control system shall perform the functions of sequential operation, interlocks and protection.

It is intended to control the unit automatically through a number of sequences with operator's intervention for initiation of each sequence. The sequence shall be executed as per the defined program.

14.0 Operator Station, Operator Control, Plant Information And Monitoring Stations/Operator Sub System

Operator Station

Operator station shall perform operator control function, plant monitoring and display function, alarm functions, logging functions, historical data storage & retrieval functions. Total two (2) Nos. of operator stations are envisaged for each section to execute all the functions specified above & elsewhere in specification. Minimum 64 bit computers along with all the peripherals shall be provided for operator stations.

Operator station Specification:

- P4 (C 2 D core to due processor), 1 Ghz, 512 MB RAM, 80 GB Hard Disk,
- 1.44MB HDD, 54 x CD ROM, 2 Serial Ports,
- 1 Parallel Port, 2 USB Ports
- 17" Flat Screen Colour Monitor (TFT)
- HP inkjet Colour Printer

All functions required for supervision & remote manual control of the unit shall be performed by this station. The functions shall be performed with the help of standard pictures on monitors which shall include plant mimics. Issuance of control command shall be realized through wireless/cordless functional keyboard or optical mouse/trackball.

14.1 Plant Monitoring Display & Logging

14.2 Displays

The monitor displays shall be capable of presenting all system process input values including analog, digital and composed values. The system shall also display all control loops with all associated parameters. Typical displays shall be plant mimic displays alarm displays, bar charts, operator guidance displays, loop displays, X-Y plots and summaries.

Plant Mimic shall be displayed with current operating parameters, equipment operating status, operator guidance, alarm points etc.

The Seller shall provide with the system a minimum of 50 macro pictorial elements as defined by the owner.

System shall be capable of trending any analog point defined on the highway.

Each operator station shall maintain a minimum of 30 days history on hard disk for all process variables with sampling frequency of 1 sec.

It shall be possible to trend up to eight variables simultaneously ranging from one minute to 24 hours.

14.3 Alarm & Event Display, Alarm Monitoring and Reporting

The alarms shall be displayed on any operator monitor. System shall have facility to assign any station as alarm station. Alarm message shall be reported to the alarm station within one second of alarm detection

The following features shall be provided as a minimum :-

1. Process operating limits, viz. high limit, low limit or both high and low limits, high - high, low - low, and both high - high and low - low limits, etc. shall be assigned to specified analog inputs and calculated variables. Every limit shall have a dead band associated with it.

2. Alarm reporting/actions:

The following sequence shall be followed for detection of alarms:-

a) Audio annunciation for 5 seconds
b) Display of alarm message on alarm banner & alarm summary screen.
c) Printing of alarm message on alarm printer

Logs:

The system shall print logs/reports as defined in these **clauses**. The printing of these logs/reports shall be initiated automatically at prescribed time intervals, or initiated on demand or by the occurrence of predefined events. The exact format and printer assignments for each log will be defined by the Owner after award of contract.

i) Alarm Logs:

Print all points (analog, calculated, digital) that are off-normal at the time request is made by the operator.

ii) Log Operator Action:

The system shall have the capacity to store all operator actions. Both the nature of the actions and the individual time of each request shall be stored. This information shall be printed automatically once each twenty four hours in the form of a summary log.

14.4 Peripherals for Operator Station

Monitors

The seller shall furnish 17 " TFT numbers flat screen color monitors. All monitors shall be interchangeable. Operator station monitors shall have a fast cursor control device like a track ball/mouse. The picture shall be stable and completely free of any flickering. The screen illumination shall be enough to give good readability. The screen dimensions shall not be less than 17" screen diagonal with optical mouse.

Key Board(Cordless/Wireless)

Standard key boards for plant operator station shall be supplied. Freely programmable keys shall be available for special user application. Key Board shall be integrated into supervisors control consoles horizontal part.

Printers

All printers shall be ink jet or laser jet type. Printing speed shall be a minimum of 300 characters per second. Style of printing available shall be indicated by the Seller. The printers shall have graphic capability and any monitor screen display may be printed on the printer.

USB or DVD

Each operator station shall be provided with USB or DVD drive unit.

Hard Disk Unit

Each operator station shall be furnished with fixed hard disk of minimum 80 (GB) storage capacity as minimum for bulk storage.

14.5 Programming, Diagnos.Tic And Work Station

The work station shall have all the function of programming/ configuration/modification and documentation. The features and facilities to be included are as under:-

a) Configuration or re-configuration of a system.
b) Possibility to introduce or modify parameters.
c) Documentation of system configuration.
d) Calculation program functions.
e) Graphic editing program.

Work station shall have capability of on-line and off line program modification without affecting the performance of the system / process. While on-line, connected to process, the work station shall provide real time tuning and trouble shooting. On off-line, the work station allows control system configuration.

14.6 Communication Network Bus System

Basically two types of bi-directional networks shall be envisaged.

Remote Network to communicate between stations by use of co-axial cable or fibre optic cables.

Local network to communicate between the different modules/cards of the same station/system and extensions.

The remote bus system shall have the following features.

Redundancy in the system for high reliability of communication. The redundant buses work continuously. All bus couplers, bus interfaces etc. shall also be redundant.

Insensibility against external disturbances, noises etc. Insensitivity of a fault in one bus system to other bus system. High data transmission rate to communicate with the system response requirement.

1	Redundant	:	Yes
2.	Control	:	Master less
3.	Data Protection	:	CRC
4.	Proprietary Bus	:	No
5.	Standard	:	IEEE 802.4

The communication network shall have "open architecture" to enable the user to get the benefit of flexibility in choosing hardware & software.

14.7 Interface with Other Computer Stations

The Seller shall provide two RS-232C / RS-485 ports / MOD BUS Protocol for interface with other owner provided control systems. The format and protocol of information exchange shall be furnished during detailed Purchasing by the owner. The Seller shall include in his scope the relevant software for communication with the equipment/systems furnished by others.

14.7 Power Supply System

Each electronic cabinet shall be equipped with redundant power supply units, with an automatic switching device for input lines, with changeover time less than 10 ms in order to guarantee hold capacity of feeders for modules and I/O signals. DICS and computers & peripherals shall work on single phase AC supply from UPS and 24v DC.

14.8 Power Supplies for DICS

a) AC Supply Requirement :
The system AC power source wherever required shall be nominal 220V, 50 Hz, single phase, ungrounded power supplied from un-interruptible power supply system (UPS) of the Seller.

b) DC Power Supplies
All system devices requiring 24V DC power shall be arranged by Seller by providing 100% redundant AC/DC charger and batteries of suitable size or by providing redundant AC/DC converter. These converters shall be fed from UPS 240V AC.

14.9 System Grounding

The automatic control system shall be designed for grounding to the station ground mat at a single connection point. Insulated ground bus from this point shall be furnished to the control logic cabinets and shall be connected to an insulated copper grounding strap in each cabinet.

15.0 Field Instruments

All field sensors shall be of proven type for sugar mills applications. All transmitters shall have local digital indication. The pressure, level, mass conductivity transmitters shall be of smart type. Control supply for all 4 wire field transmitters shall be 220v AC and for 2 wire transmitters, it shall be 24v DC. Output signal from all transmitters shall be 4 to 20mA.

15.1 Sensors & Transmitters:

Water & Juice flow meters shall be of magnetic type with separate tube and transmitter. Transmitters shall be installed on working platform so that they can be viewed by operators and easily maintained by instrument Purchasers. These transmitters shall be capable of being re-calibrated in the field for new flow measuring range. The transmitters shall have local digital display indication for rate of flow and total flow.

Mass Flow meter for measuring juice flow shall be with tube and separate transmitter. The transmitter shall display juice flow rate, juice density, juice temperature and total juice flow. Juice flow meter shall be suitable for cane juice which is acidic in nature and contains suspended matter like bagacillo, mud, etc.

The mill load sensors shall be 2 wire pressure transmitters for turbine drives and dual output channel signal converters for electric drives.

Juice tank, evaporator and pan level transmitters shall be 2 wire sealed diaphragm type pressure & DP transmitters, suitable for 4 to 20mA output signal. Open tank level transmitters shall be with single capillary and closed tank transmitters shall be with dual capillaries. Capillary length shall be suitable for the height of the vessel.

The syrup storage tank level transmitters shall be of ultrasonic type or sealed diaphragm type with remote seal and capillary of minimum 5 meters length or as required by equipment design. These transmitters will be of 2 wire type.

The vapour pressure and vacuum transmitters shall be of 2 wire type with capacitance sensing method. They shall have local digital display and 4 to 20 mA output signal.

The temperature sensors shall be RTDs, type PT100, with immersion length to suit the application and adjustable screw head. Thermo wells shall be supplied with RTDs., which shall be connected to temperature transmitters to give 4 to 20mA signal to the PLC/DCS system. Temperature transmitters shall have accuracy of +/- 1 deg. C with no drift over a period of time.

15.2 Control Valves:

Water flow control valve shall be globe type and juice flow control valve shall be butterfly type, with pneumatic actuators. The body and trim of both control valves shall be of SS in view of acidic nature of mill juice. Juice flow control valve shall be tight shut off type with PTFE seat to avoid any leakage when valve closes fully. Control valves shall be complete with valve positioners, hand wheel and limit switches. I/P converters, filter/regulators, copper tubing fittings shall be in Seller's scope of supply.

Juice Heater vapor control valves shall be butterfly type, with pneumatic or motorized actuators. The body of these valves shall be of cast steel and trim of SS. Control valves shall be complete with valve positioners, hand wheel and limit switches. I/P converters, filter/regulators, copper tubing fittings shall be in Sellers' scope of supply.

Feed control and vacuum control valves shall be Globe type, with pneumatic actuators. The body and trim of these valves shall be of SS. Control valves shall be complete with valve positioners, hand wheel and limit switches. I/P converters, filter/regulators, copper tubing fittings shall be in Sellers' scope of supply.

Steam control valves shall be Globe type, with pneumatic actuators. The body and trim of these valves shall be of SS. Control valves shall be complete with valve positioners, hand wheel and limit switches. I/P converters, filter/regulators, copper tubing fittings shall be in Sellers' scope of supply.

15.3 Supervisory Control Console & Equipment Panels

15.3.1 Supervisory Control Consoles

Supervisory control consoles for mounting operator & Purchasering stations shall be supplied. The console shall form one complete unit along with two end sections for writing space. Adequate number of table/desks/stands for accommodating printers in Seller's scope shall be supplied.

15.3.2 Cabinets

i) All control system modules, power supply components, other control devices (except field mounted sensors/transmitters and electric to pneumatic converters) and termination's which are required for completeness of control systems shall be housed in DICS cabinets furnished by the Seller. All equipment and termination's required for proper interface with other systems shall also be housed in these DICS cabinets.

ii) Cabinets shall be designed for plug-in installation for control system modules. The system modules relating to a particular sub-system or system shall be grouped together and housed in the same assembly to the extent possible.

iii) Cabinets shall be of NEMA-2 (IP-31) protection class. The Seller shall ensure that the packaging density of equipment in these cabinets is not excessive and abnormal temperature rise, above the cabinet temperature during normal operation in air-conditioned environment and also during the period of air conditioning failure, is prevented by careful design. The Seller shall ensure that the temperature rise is limited to 10 degree C above ambient.

iv) Cabinets shall be designed for front access to system modules and rear access to wiring. All wiring in cabinets shall pass the vertical flame test for IPCEA S-19-81.

15.3.3 Constructional Features of Panels, Cubicles & Enclosures

All panels, cubicles, consoles and enclosures furnished as per this specification shall be of free standing type and shall be constructed of specified gauge of steel plates. The panel sheet thickness shall be not less than 2 mm unless otherwise specified herein.

15.3.4 Panel Wiring

Interconnecting wiring shall be provided between all electrical devices mounted in the panels, and between the devices and terminal blocks if the devices are to be connected to equipment outside the panels. The Seller shall install jumpers between terminal blocks.

15.3.5 Panel Illumination

Panels shall be provided with fluorescent illuminating lamps with door switch and three (3) point 15A, 240V AC sockets with switch for maintenance purposes.

15.3.6 Grounding

All panels and cabinets shall be provided with a continuous bare copper ground bus of minimum 6mm x 12mm cross section. The ground bus shall be bolted to the panel structure and effectively ground the entire structure. Each ground bus shall have provision at each end for connection of Owner's ground leaks (6mm x 50mm GI flats) by suitable bolting. All system cabinets shall be brought to a common system ground by the Seller.

16.0 Uninterruptible Power Supply System

16.1 General Requirements

UPS system shall be provided separately for each section. The Seller shall furnish an integrated UPS system including static inverters, static switches, manual bypass switch, chargers, stationary battery, AC power distribution panels with all required isolating and protecting devices and all other equipment and accessories required for completeness of this system. Capacity of UPS shall be proposed by Seller to suit the system power requirements and this capacity shall be received and finalized during detail Purchasering stage.

All control and instrument circuits shall be with fuse. Fuses shall be mounted inside the enclosures and shall have easy accessibility.

16.2 Functional Requirements

The Uninterruptible Power Supply (UPS) system of continuous duty shall supply regulated, filtered and uninterrupted 230V, 50 Hz, single phase power, within specified tolerances, to system AC loads. Each inverter shall supply only 50% loads under normal

conditions. All necessary equipment required for protecting UPS equipment and connected inputs and outputs shall be furnished by the Seller as an integral part of this system.

Normal Operation

Two inverters each of 100% capacity, two battery packs of 100% capacity and two 100% battery chargers are used.

Emergency Operation

The static transfer switches and the manual by-pass switch shall provide switching means during emergency operation.

16.3 Static Inverters And Auxiliary Equipment

The static inverters shall be solid state type employing silicon controlled rectifiers or power transistors and other solid state devices to convert direct current power to essentially sinusoidal alternating current. The inverter equipment shall include all necessary circuitry and devices to conform to requirements like voltage regulation, current limiting, wave shaping, transient recovery, surge suppression network, automatic synchronization etc. as specified herein.

Input Voltage

The inverters shall be fed from a sealed maintenance free battery and chargers which do not feed any other loads. Filtering on the input of the inverters shall be furnished as required to operate with the output ripple of the chargers.

Automatic Synchronization

Inverter equipment shall include stable solid state oscillator devices designed to automatically maintain the inverter output in phase and in synchronism with the standby AC source.

16.4 Manual By-Pass Switch

The manual by-pass switch will be used to isolate any static switch from its load and stand-by power supply and to take the static switch out of service without power interruption to the load. The manual by-pass switch shall also provide the facility for by-passing the entire UPS system during startup at the option of the operator.

The manual bypass switch shall have make before break contacts to ensure continuous supply to UPS loads during the operation of this by-pass switch.

16.5 Float-Cum-Boost Chargers And Auxiliary Equipment

Two 100% capacity chargers shall be furnished for each UPS system. Each charger shall confirm to the following requirements.

Each charger furnished for UPS system shall be adequately rated to ensure that any one shall meet full DC load of UP system operating at 100% rating plus recharge the fully discharged UPS battery within 8 hours.

Each charger shall be furnished with a ground detector system consisting of a relay and a center tapped resistor.

16.6 Technical Specification for Sealed Maintenance Free Batteries

The design of battery shall be as per field proven practices. Partial plating of cells is not

permitted. Paralleling of cells externally for enhancement of capacity is not permitted up to 1500 AH capacity.

The container shall have chemical and electro-chemical compatibility. It shall be acid resistant and fire retardant. Fixing of Pressure Regulated Valve terminal posts in the cover shall be such that the seepage of electrolyte gas escapes and entry of electro static spark are prevented.

All batteries shall be mounted in a suitable metallic trays / frame. Cells shall be housed in a ventilated & protected modular steel tray to promote airflow between the cells for effective thermal management.

Battery sets will be tested at the manufacturing premises prior to the dispatch of material & shall meet a min of 100% capacity at 10 Hr. discharge rate from very first cycle.

16.7 Step-Down Transformer & Voltage Stabilizer

One 415 Volt, 3 phase to 230 Volt, single phase transformer along with associated voltage stabilizer shall be furnished. This transformer and stabilizer combination shall convert Owner furnished 415 Volt $\pm$ 10% plant auxiliary AC supply to 230V $\pm$ 2% single phase standby AC Power which will serve as UPS system back up supply source.

16.8 AC Distribution Boards

Panel boards for distribution of continuous AC power to essential loads shall be dead-front type panel boards rated for 600 V, AC service. The hinged panel board front shall cover the fuses and wiring gutter but not the switch handles. The hinged front and switch handles shall be covered by the enclosure door.

17.0 Standard Colour Scheme

Following standard Colour Scheme shall be followed.

Air Compressors, Fans, Vacuum Pumps	Ultramarine
Air receivers	Aqua
Electric motors, equipment	Orange
Handrails, Safety guards	Golden Yellow
Mills, Inter carriers, Feed Chutes etc.	Palm Green
Mill Gearing	Cream
Pumps, Gearboxes	Turquoise
Piping	Condensate, Cold Water Jade
Drain	Black
Flocculent	Lichen
Fire Fighting	Signal Red
HP Steam	Pearl Grey
Hot Water	Jade
Instrument Air	Aqua
Injection Water	Jade
Lime Slurry	Lilac
LP Steam	Pearl Grey
Massecuite	Cream
Overflow	Same as tank or vessel
Oil / Lubricants	Golden Tan
Plant Air	Aqua
Potable Water	Jade
Saccharate Solution	Lilac
Sodium Hydroxide	Lilac
Sodium Hypochlorite	Lilac

Sugar Syrup	Cream
Torri Water	Jade
Vapour or Vent	Same as tank or vessel
Structural Steel work	Smoke Blue
Screw conveyors, distributors,	
Sugar bin	Palm Green
Tanks & Vessels :	
Process	Cream
Water	Jade
Caustic, Acid	Lilac
ime Saccharate	Lilac
Flocculent	Lichen
Hydraulic	Golden Tan
Turbines	Pearl Grey

18.0 Drawings and Documents

All drawings, manuals and other related information of the specified equipment shall be submitted.

- The supplier shall be responsible for any discrepancies, errors and omissions in the drawings submitted by him, not withstanding any approval accorded by the Purchaser.

- All costs as a consequence of errors in drawings and documents shall be borne by the Supplier.

- All drawings, technical literature, manuals and parts lists shall be provided by the Supplier as may be required for facilitating erection, commissioning, operation and maintenance of the plant.

- Where the Supplier is contracted to supply a system of connected plant items, flow diagrams shall be submitted showing the relationship of the connected items to each other and outlining terminal points.

- The supplier shall provide arrangement drawings together with berthing diagrams and details of static and dynamic loadings, cutouts, openings, trough holes as applicable, to permit design of civil works.

- All drawings, parts lists, service and maintenance manuals shall be supplied in sextuplicate for use of the Purchaser, the Consultant and the erection, commissioning and operating personnel. Where specialized maintenance manuals are not available, standard manufacturer's literature shall be provided.

- Wiring diagrams for instrumentation shall indicate wire numbers, drawn as viewed from front to back of panels.

19.0 Quality Assurance, Testing and Guarantees

19.1 Performance & Tests

Some of the applicable Indian and Overseas Standards related to Tests on various equipment of the Plant are listed under Clause 2.1.2. The list is not meant to be comprehensive. For the Standards, which are not mentioned in the list, relevant Indian or overseas standard should be followed. In all cases, latest version of relevant Standard should be applicable.

Standards for Tests

On overall completion of erection and commissioning, performance tests of unit equipment of the Plant and systems shall be conducted to verify conformity with specified capacities and efficiencies. Such performance tests shall be conducted in accordance with procedures prescribed in relevant Standards. Where Indian Standards Specifications do not provide relevant test procedures, the Supplier shall submit to the Purchaser for approval, the test procedures to be adopted. The Purchaser's decision in such cases shall be final.

Acceptance of the equipment, as a result of these performance tests shall in no way relieve the Supplier from its obligations with respect to the Defects warranty clause or with respect to any other condition applicable under the contract.

Equipment of the Plant

As and when erection of equipment of the Plant are completed, tests will be conducted, as appropriate which would include but may not be limited to the following:

- Dimensional and quantity checks
- Conformity to specifications
- Hydraulic tests of tanks, vessels, pipelines etc.
- Mechanical tests on rotating machinery like pumps, compressors, fans, turbines etc.
- No load running tests on conveyors and other mechanical drive systems
- Standard running tests on rotating mechanical and electrical machinery
- Vibration tests on rotating mechanical and electrical machinery.

19.2 General Requirements

All equipment furnished under this specification shall be subject to test by authorized quality assurance personnel of the Seller, representatives of the purchaser and/or Technical Specialist during manufacture, erection and on completion. Seller's quality assurance personnel for these shop and site tests shall be identified in advance and shall be acceptable to the purchaser. The approval of the Purchaser /Technical Specialist or passing of such inspection of tests will not, however, prejudice the right of the owner to reject the equipment if it does not comply with the specifications when erected or fails to give complete satisfaction in service.

The Seller shall furnish details of shop and site tests proposed to be conducted by him at various stages to meet the specification requirements for each type of instrument/system along with his proposal. Seller shall also furnish details of his proposed shop and site quality assurance organization for this contract.

Seller shall prepare a detailed shop and site 'Quality Assurance Program' to meet the requirements of these specifications for purchaser's approval. This document shall also contain the formats for reports and maintenance of test records, specification of test equipment to be used for site tests.

19.3 Shop Tests

19.3.1 General Requirements

Shop tests shall include all tests to be carried out at Seller's works, at works of his sub-Seller's and at works where raw materials used for manufacture of equipment is produced.

19.3.2 Material Tests

Whenever tested quality material is specified and wherever called upon by Safety Regulations or by the design code, the test pieces are to be prepared and tested to purchaser's satisfaction.
In the event of purchaser being furnished with certified particulars of tests which have been carried out by the suppliers of material, the purchaser may, at his discretion, dispense with these tests.

19.3.3 Tests at Manufacturer's Works

Works tests are to include electrical, mechanical performance and hydraulic tests in accordance with relevant codes or any other approved standard or any other tests called for by the purchaser under these specifications to ensure that the equipment being supplied fulfills the requirements of these specifications.

19.3.4 On-Site Tests

All the site activities including unloading, storage cum insurance of equipment and materials on arrival to site, installation, commissioning and carrying out all the tests at site shall be performed by the Seller at no cost to the purchaser in presence of Purchaser/Consultant's representatives and with the permission of owner as and when required.
The Seller shall furnish the necessary manpower and the services of technical representative(s), who shall provide technical guidance and advice for the installation of the equipment and placing the system in operation. The services of the technical representative(s) shall be available for the period from arrival of the equipment on site until the equipment is finally accepted by the purchaser. The on-site tests shall include the following tests in the sequence given:-

a) Inspection of Equipment on Arrival

The Seller's field representative(s) shall inspect all supplied equipment upon arrival on-site. All observed damage to equipment shall be reported to the Purchaser /Purchaser.

b) Preliminary On-Site Checks and Tests

After field installation and before equipment energisation and connection of field inputs, the Seller shall carefully inspect all equipment and shall check all Seller supplied wiring and cable to assure correctness of corrections and proper equipment installation.

c) Start-up

On completion of erection of the equipment and before start-up, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the purchaser and the Seller for correctness and completeness of installation and acceptability for start-up, leading to initial pre-commissioning tests at site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Seller's quality assurance program.

d) Trial Operation

The plant shall then be on trial operation during which period all necessary adjustments shall be made while operating, over the full load range enabling the plant to be made ready for performance and guarantee tests.

The duration of Trial operation of the complete equipment shall be 7 days out of which at least 72 hours shall be continuous operation on full load or any other duration as may be agreed to, between the purchaser and the Seller. The Trial Operation shall be considered successful, provided that each item of the equipment can operate continuously at the specified operating characteristics, for the period of Trial Operation.

e) System Documentation Check

Upon successful completion of the preliminary ON-Site checks and Tests the purchaser's and the Seller's representative shall check that all required system documentation, in its final form was delivered to the purchaser. All error and insufficiencies in the system documentation, (manuals, drawings, software) shall be corrected by the Seller before the system is accepted by the purchaser. Duly corrected system documentation shall be furnished to purchaser and Consultant.

20. Performance and Guarantee Test and Acceptance of the System by purchaser

Dynamic load tests while maintaining safe process conditions and without endangering the equipment. All tests will be performed with the system in automatic mode:

a) Drop 50 per cent of maximum load capability from approximately full load at a rate of 10 per cent per minute.

b) Drop load from full rated output to the lowest load runback limit, at a rate corresponding to the fastest runback rate.

c) Pick up 50 per cent of the maximum load capability from approximately 50 per cent load at a rate of 10 per cent per minute.

During transient conditions causing deviation of process variables, the control system furnished under this specification shall not permit deviations which exceed those permitted by the manufactures of the controlled process equipment, for load demand changes upto 10 percent of rated full load capability per minute. Controlled process variables shall return to normal in a stable manner and without any loop interactions or cycling of generation when generation matches unit load demand.

21.0 Painting

The plant shall be painted before dispatch to Site. Painting specifications are furnished hereunder. To facilitate correct re-assembly of gearing, turbines, vessels, etc. at Site, colour identification shall be applied to each plant piece and its associated equipment of the plant and parts, within a series or train of similar pieces.

Preparation of surfaces

Prior to treatment, the metal surface shall be cleaned of dirt and grease, layer of rust, weld spatter etc. These shall be removed by pickling, power tool chipping, de-scaling, sanding, wire brushing or grinding. For wire brush cleaning, the wire brush shall be applied carefully over the surface in vertical and horizontal direction.

For motor driven cleaning, brush, tube cleaner and disk sander shall be used. The work shall be done in such a way that the brush is applied over two times on each portion of the object to be treated. Either feather type or gear type cutter shall be attached to the tube cleaner. Application of the cutter shall be done carefully in the longitudinal direction except for unavoidable cases.

Recommended types of paints

Painting for Machinery, Equipment of the Plant, and Piping shall be applied as follows:

Primary coat	Red Oxide Paint
Under Coat	Phallic Anhydride Paint
Finish Coat	Phallic Anhydride Paint
Corrosion protection (wherever required)	Pitch based resinous

Galvanized Steel

Internal surface of vessels, tanks, heat exchangers, etc.

Machine finished surface where performance will be adversely affected if painted. In the case of layered painting, the next painting shall be applied after cleaning the surface of the previous layer and after a gap of minimum 8 hours drying.

The coating thickness of each layer shall be uniform. Notices, name plates, lettering, gauges, sight glasses and similar items shall not be painted over and shall be protected during painting by the application of masking tape and cleaned after painting is over.

Painted Film Thickness

The thickness of finish painted film shall be even. The standard thickness values to be measured by net micro-thickness gauge shall be as follows:

Red Oxide paint	Over 125 (4 coat basis)
Phallic acid resin paints	Over 150 (4 coat basis)

22.0 Packing

All equipment of the Plant shall be packed as necessary to provide adequate protection during delivery to Site.

The Goods shall be fully protected from weather and corrosion by suitable paint, preserving grease or wax paper together with silica-gel or any other protective hygroscopic material, as may be required.

The packing cases shall be lined internally with tarred paper or polythene and the lids lined internally with roofing paper.

The packing cases shall be of substantial timber construction screwed or nailed together and shall be provided with skids preventing direct contact with the ground or floor, and permitting the use of fork-lift trucks or slinging for lifting by cranes.

Small items shall be gathered together and transported in packing cases.

ANNEXURE-III

PERFORMANCE PARAMETERS

1.0 Input Parameters:

Raw Material	Sugar Cane
Fibre% Cane	Not more than 16.0
Pol% Cane	Not more than13.5

1.1 The following performance parameters are to be achieved at a crush rate of 1500 tons/22 hrs. of sugarcane per day continuously for duration of five days (refer para 9.2)

1.1.1 Capacity of Plant

The plant to achieve a crush rate of 1500 TCD/22 hrs. continuously for 5 days.

1.1.2 Milling Plant

i) The preparation index of prepared cane shall be 85 plus. The preparation Index shall be determined by Aldrich/Rayner CCR Australian method.

ii) The reduced mill extraction shall be 95% plus at 220% imbibition on fibre, calculated by Mittal formula.

iii) Moisture per cent of last mill bagasse shall not be more than 50%.

1.1.3 Steam Generation Plant

i) Thermal efficiency 70% continuously (IS code) on GCV of bagasse having 50% moisture with inlet condensate of 95 deg C.

ii) Steam Generation capacity **MCR** shall be 40 tonnes/hr. continuously for a period **of** 24 hrs. at 72 ata at 510°C.

iii) Pressure & temperature drop in HP piping between super heater outlet and power turbine's TSV/s: Shall not be more than 1.5 kg/sq. cm. g. and 5 deg. C respectively.

iv) Steam generation for peak capacity shall not less than 110% of MCR for ½ hour.

v) Flue gas temp. - 160°C **at inlet of ESP.**

1.1.4 Power Generation Plant

The power turbine should generate 4950 KW continuously.

i) Specific steam consumption should not be more than 6.25 kg/KWH/hr. at full load condition.

1.1.5 Boiling House

The plant while producing premium white sugar of any grade from L-31, M-31, S-31 and shall achieve an average reduced boiling house recovery (Gundu Rao formula) of 90%.

1.1.5.1 Juice heater

a. VLJH on 5th effect vapor : Rise in juice temperature shall not be less than 12 ^{o}C

b. Raw juice 2nd stage heating from 4th effect vapor : Rise in Juice temperature shall not be less than 28 deg.C.

c. Sulphited juice heaters: 1st Stage Rise in temperature shall not be less than 20 deg C by vapor at 98 deg C and 2nd stage 15°C by vapor at 118 deg C

d. Clear juice heater:

Minimum 10 deg. temreture rise should achieve after clear juice heating

1.1.5.2 Milk of Lime preparation, Juice Sulphiter and Clarifier: Clear juice obtained should be free from suspended mud particles. One lit. of muddy juice sample the dry insoluble solids should be a minimum of 50 grams.

1.1.5.3 Vacuum filter:

Vacuum filter efficiency (mud solids retention) should not be less than 75% based on the average of 6 samples taken under regular working conditions. The bagacillo should be available at the rate of 8 kgs per tonne of cane per hour. Pol% filter cake should not more than 1.5 at wash water of 100% on cake.

1.1.5.4 Evaporation Plant

i) The evaporator should be able to give upto 80-82% evaporation.
ii) The Syrup Brix at the outlet shall not be less than 65 Bx

1.1.5.5 Vacuum Pans:

i) Minimum vacuum at the pan body shall be 635 mm at mean sea level.

ii) Total cycle time (full strike level) should not be more than the following:
A massecuite 2.5 hours

iii) B & C Batch Pans - Capacity of the pans as specified in **Annexure-I(B)** And Brix of the output masseuites as below.
A Massecuite Brix of 92-93
B Massecuite Brix of 95-96
C Massecuite Brix of 99-101

1.5.1.6 Condensers

i) Minimum vacuum in the body of the condenser shall be 650 mm.

ii) Difference of temperature between vapours to be condensed and tail pipe water temperature shall be less than 10 deg C.

1.1.5.7 Water Cooling System

i) Minimum drop of 10 deg C or within 5 deg C of wet bulb temp. shall be achieved during season.

ii) The total power consumption at cooling and condensation station shall not exceed 1.8 kw/tonne cane crushed.

1.1.5.8 Crystallizers

i) Minimum purity drop in 'C' crystallizers should be 4 units reckoned from 'C' pan dropping massecuite to over flow of 'C' continuous crystallizers.

ii) 'B' massecuite should be cooled from 65ºC to 50ºC in 8 hours when supplied with cooling water at 30ºC.

iii) 'C' massecuite should be cooled from 65ºC to 40ºC in 15 hours when supplied with cooling water at 30ºC.

iv) The cooled 'C' massecuite shall be reheated rapidly from 40ºC to 50ºC but the final temperature should not exceed more than 52ºC.

1.1.5.9 Centrifugal Machines

i) Capacity of a batch machine shall be judged for average cycles during continuous 4 hrs. working and for continuous machines for 4 hours continuous working for consecutively for five days respectively.

ii) The guaranteed capacity of continuous centrifugal machines shall be linked to following:

iii) 'B' massecuite brix 94-96 purity not exceeding. 65.0

iv) C' massecuite brix 99-101, purity not exceeding 50.0.

1.2 Performance Parameters of Centrifugal Machines.

i) Purity of single cured 'C' sugar shall not be less than 80.
ii) Purity of double cured 'C' sugar shall not be less than 92.
iii) Purity increase between Nutsch molasses purity ('C' massecuite fed 'C' fore workers) and final molasses purity from 'C' foreworker machines shall not be more than 1.5.
iv) Purity of 'B' single cured sugar shall not be less than 95.0
v) Capacity of A machines shall be 1250 kg/charge and number of cycle shall not be less than 20.
vi) Continuous machines for C-fore curing shall be of minimum 7.0 tonnes/hr. capacity.
vii) B-curing & C-after curing continuous machines shall be of minimum 12 tonnes/hr. capacity.

1.21 Filed Instrument & Control System

1.2.1 Field Instruments:

All field instruments (Absolute Pressure, temperature, Level, pH, Brix/conductivity, Pressure, Flow transmitter and Final control element (control valve, power cylinder etc). Accuracy should be +/- 2%. Error more than 5% will not be accepted

1.2.1 Control System :

All DCS control systems at boiler/power house, mill house, clarification house and pan station should be functional as per program and parameters preset in the DCS for the control. All graphics and mimic diagrams, datas to be displayed and on DCS MMI.

By passing of any control system or its MMI interface during the performance trial of plant machinery/process equipment will not be acceptable.

ANNEXURE IV

BG - I

PROFORMA OF BANK GUARANTEE AGAINST FIRST ADVANCE PAYMENT

(5% of the contract price)

(To be submitted as per clause 19.2.1

Bank Guarantee No._____

The General Manager
Rajasthan State Ganganagar Sugar Mills Ltd.,
4th Floor, Nehru Sahkar Bhawan,
Bhawani Singh Road,
Jaipur (Rajasthan)

1. WHEREAS Rajasthan State Ganganagar Sugar Mills Ltd., a Company incorporated under the Companies Act, 1956, having its Registered Office at **4th Floor, Nehru Sahakar Bhawan, Bhawani Singh Road, Jaipur -302006 (Rajasthan)** (Hereinafter referred to as the "Purchaser" which expression shall unless repugnant to the context include its successors, executors administrators, legal representatives and assigns) is setting a 1500 TCD Expandable to 2500 TCD Sugar Plant with 4.95 MWH Bagasse based Co-Generation Power Plant on turnkey basis at Chak – 23 'F', Kaminpura, Tehsil – Srikaranpur, Distt. Sriganganganagar - 335001 (Rajasthan).

2. WHEREAS (name and address of the Sellers) (hereinafter called 'The Sellers' which expression shall unless repugnant to the subject or context include their legal representatives, administrator, successors or permitted assignees) has entered into with the Purchaser a Contract dated _____ (hereinafter called the said Agreement) to design, manufacture, supply, erection, commissioning and performance of the Plant and equipment in accordance with the terms and conditions therein contained (hereinafter referred to as 'the said Plant and Equipment).

3. AND WHEREAS in conformity with the provisions of clause _____ of the said contract, the seller has agreed to furnish a Bank Guarantee for an amount equivalent to the first initial advance payment of Rs. _____ extended by the Purchaser to the seller for the faithful execution of the supply part of contract.

4. AND WHEREAS the Purchaser has agreed to accept a Bank Guarantee of Schedule Bank for Rs_____ from seller of having its Head Office at _____ _____ through its Branch _____ (hereinafter referred to as "The Bank" which expression shall unless repugnant to the context include its successors and assigns) Representing 5% against first advance of the contract price mentioned at **clause 2** of Financial Bid.

5. In consideration of the above, the Bank hereby unconditionally and irrevocably guarantees and undertakes as a direct responsibility, to pay to the Purchaser on demand any and all moneys payable by the Seller on account of advance payment extended by the Purchaser to the Seller without any demure, reservation, recourse, contest or protest and/ or without reference to the Seller.

6. Any such demand made by the Purchaser on Bank shall be conclusive and binding notwithstanding any difference between Purchaser and the Seller or any dispute pending

before any court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee herein contained and this guarantee shall continue to be enforceable till the Seller discharges its obligation under the contract.

7. The decision of the Purchaser as to whether the Seller has fulfilled its obligation or not towards set-off of advance payment extended by the Purchaser to the Seller shall be final and binding on the Bank and the Seller.

8. The Purchaser shall have the fullest liberty without affecting in any way the liability of the bank under this guarantee from time to time extend the time for performance of the contract by the Seller. The Purchaser shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Seller, and to exercise the same at any time in any manner, and either to enforce or to forebear to enforce any covenants contained or implied in the Contract between the Purchaser and the Seller or any other course of remedy or security available to the Purchaser. The bank shall not be released of its obligations under these presents by any exercise by the Purchaser of its liberty with reference to matter aforesaid or any of them or by reason of any other act or forbearance to other acts of omission or commission on the part of the Purchaser of any other indulgence shown by the Purchaser or by any other matter or thing whatsoever which under the law would, but for this provision, have the effect of relieving the Bank.

9. The bank also agrees that the Purchaser at its opinion shall be entitled to enforce this guarantee against the Bank as a principle debtor, in the first instance without proceeding against the Seller , and notwithstanding any security or other guarantee that the Purchaser may have in relation to the Seller's liabilities.

10. This guarantee shall be valid for a period of _____ months from _____ i.e. upto _____ or upto completion of supply of all equipments of plant & machinery whichever is later and shall be valid for the due period as per the terms of contract. The Guarantee herein contained shall be a continuing Guarantee and shall not be affected by any change in the constitution of the Bank or be affected by the any other security now or hereafter held by the Purchaser and Purchaser at its discretion and without any further consent from the Bank and without affecting the liability of "the Bank" and other indulgence to or make other arrangements with the Seller and nothing done or omitted to be done by the Purchaser in pursuance of any authority contained in this guarantee shall affect or discharge the liability of the Bank.

11. The Bank guarantee shall remain binding and irrevocable notwithstanding such variations, alterations or extensions of completion time as may be made, given conceded, agreed to between the contractor and the RSGSML under the general conditions otherwise.

12. The Guarantor shall pay to the Purchaser on demand the sum under **Clause 4** above without demur and without requiring the Purchaser to invoke any legal remedy that may be available to him, it being understood and agreed, FIRSTLY that the Purchaser shall be the sole judge or and as to whether the Sellers have committed breach/or breaches, of any of the terms and conditions of the Agreement and the extent of loss, damage, costs, charges and expenses caused to or suffered by the Purchaser from time to time shall be final and binding on the Guarantor and SECONDLY that the right of the Purchaser to recover from the Guarantor any amount under this Guarantee shall not be affected or suspended by reasons of the fact that any dispute or disputes have been raised by the Sellers with regard to their liability or that proceedings are pending before any Court with regard thereto or in connection therewith and THIRDLY that the Guarantor shall immediately pay the

aforesaid guaranteed amount to the Purchaser on demand and it shall not be open to the Guarantor to know the reasons of or to investigate or to go into merits of the demand or to question or to challenge the demand or to know any fact affecting the demand and LASTLY that it shall not be open to the Guarantor to require proof of the liability of the Sellers to pay the amount before paying the aforesaid guaranteed amount to the Purchaser.

13. The Sellers and the Purchaser will be at liberty to vary and modify the terms and conditions of the said agreement without affecting this guarantee, notice of which modifications to the Guarantor is hereby waived and the same shall be deemed to have been done with the assent of the Guarantor.

14. Notwithstanding anything herein before above contained, the liability of the Bank under this Guarantee shall be restricted to Rs. _____ being the amount of advance payment extended by the Purchaser to the Seller and the Guarantee shall remain in force upto and including.

15. This Bank Guarantee shall be revalidated automatically till the entire completion of supply of plant & machinery.

IN WITNESS WHEREOF we have set our hands and seal hereunder at this _____ day of _____ at _____

Witnesses: For and on behalf of the Guarantor

Note :

a. Bank Guarantee should be on Rs. 100/- Non-Judicial Stamp Paper.

b. Stamp Paper to be purchased from the Rajasthan State Government in the name of the bank issuing the Bank Guarantee.

ANNEXURE V

BG - II

PROFORMA OF BANK GUARANTEE AGAINST SECOND ADVANCE

(5% of the contract price)

(To be submitted as per clause 19.2.2)

Bank Guarantee No._____

The General Manager
Rajasthan State Ganganagar Sugar Mills Ltd.,
4th Floor, Nehru Sahkar Bhawan,
Bhawani Singh Road,
Jaipur,
Rajasthan State

1. WHEREAS Rajasthan State Ganganagar Sugar Mills Ltd., a Company incorporated under the Companies Act, 1956, having its Registered Office at 4th Floor, Nehru Sahakar Bhawan, Bhawani Singh Road, Jaipur -302006 (Rajasthan) (Hereinafter referred to as the "Purchaser" which expression shall unless repugnant to the context include its successors, executors administrators, legal representatives and assigns) is setting a 1500 TCD Expandable to 2500 TCD Sugar Plant with 4.95 MWH Bagasses based Co-Generation Power Plant on turnkey basis at Chak – 23 'F', Kaminpura, Tehsil – Srikaranpur, Distt. Sriganganganagar - 335001 (Rajasthan).

2. WHEREAS (name and address of the Sellers) (hereinafter called 'The Sellers' which expression shall unless repugnant to the subject or context include their legal representatives, administrator, successors or permitted assignees) has entered into with the Purchaser a Contract dated _____ (hereinafter called the said Agreement) to design, manufacture, supply, erection, commissioning and performance of the Plant and equipment in accordance with the terms and conditions therein contained (hereinafter referred to as 'the said Plant and Equipment).

3. AND WHEREAS in conformity with the provisions of clause _____ of the said contract, the seller has agreed to furnish a Bank Guarantee for an amount equivalent to the second advance payment ('Advance Payment') of Rs. _____ extended by the Purchaser to the seller for the faithful execution of the part upto timely Supply of Plant and Machinery.

4. AND WHEREAS the Purchaser has agreed to accept a Bank Guarantee of Schedule Bank for Rs_____ from seller of having its Head Office at _____ through its Branch _____ (hereinafter referred to as "The Bank" which expression shall unless repugnant to the context include its successors and assigns) Representing 5% against second advance of the contract price mentioned at **clause 2** of Financial Bid.

5. In consideration of the above, the Bank hereby unconditionally and irrevocably guarantees and undertakes as a direct responsibility, to pay to the Purchaser on demand any and all moneys payable by the Seller on account of advance payment extended by the Purchaser to the Seller without any demure, reservation, recourse, contest or protest and/ or without reference to the Seller.

6. Any such demand made by the Purchaser on Bank shall be conclusive and binding notwithstanding any difference between Purchaser and the Seller or any dispute pending before any court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee herein contained and this guarantee shall continue to be enforceable till the Seller discharges its obligation under the contract.

7. The decision of the Purchaser as to whether the Seller has fulfilled its obligation or not towards set-off of advance payment extended by the Purchaser to the Seller shall be final and binding on the Bank and the Seller.

8. The Purchaser shall have the fullest liberty without affecting in any way the liability of the bank under this guarantee from time to time extend the time for performance of the contract by the Seller. The Purchaser shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Seller, and to exercise the same at any time in any manner, and either to enforce or to forebear to enforce any covenants contained or implied in the Contract between the Purchaser and the Seller or any other course of remedy or security available to the Purchaser. The bank shall not be released of its obligations under these presents by any exercise by the Purchaser of its liberty with reference to matter aforesaid or any of them or by reason of any other act or forbearance to other acts of omission or commission on the part of the Purchaser of any other indulgence shown by the Purchaser or by any other matter or thing whatsoever which under the law would, but for this provision, have the effect of relieving the Bank.

9. The bank also agrees that the Purchaser at its opinion shall be entitled to enforce this guarantee against the Bank as a principle debtor, in the first instance without proceeding against the Seller , and notwithstanding any security or other guarantee that the Purchaser may have in relation to the Seller's liabilities.

10. This guarantee shall be valid for a period of _____ months from _____ i.e. upto _____ i.e. upto timely supply of all equipments of plant & machinery as per PERT Chart and under delay **clause 15**. The Guarantee herein contained shall be a continuing Guarantee and shall not be affected by any change in the constitution of the Bank or be affected by the any other security now or hereafter held by the Purchaser and Purchaser at its discretion and without any further consent from the Bank and without affecting the liability of "the Bank" and other indulgence to or make other arrangements with the Seller and nothing done or omitted to be done by the Purchaser in pursuance of any authority contained in this guarantee shall affect or discharge the liability of the Bank.

11. The Bank undertakes not to revoke this Guarantee during its currency except with the previous consent of the Purchaser in writing.

12. The Guarantor shall pay to the Purchaser on demand the sum under **Clause 4** above without demur and without requiring the Purchaser to invoke any legal remedy that may be available to him, it being understood and agreed, FIRSTLY that the Purchaser shall be the sole judge or and as to whether the Sellers have committed breach/or breaches, of any of the terms and conditions of the Agreement and the extent of loss, damage, costs, charges and expenses caused to or suffered by the Purchaser from time to time shall be final and binding on the Guarantor and SECONDLY that the right of the Purchaser to recover from the Guarantor any amount under this Guarantee shall not be affected or suspended by reasons of the fact that any dispute or disputes have been raised by the Sellers with regard to their liability or that proceedings are pending before any Court

with regard thereto or in connection therewith and THIRDLY that the Guarantor shall immediately pay the aforesaid guaranteed amount to the Purchaser on demand and it shall not be open to the Guarantor to know the reasons of or to investigate or to go into merits of the demand or to question or to challenge the demand or to know any fact affecting the demand and LASTLY that it shall not be open to the Guarantor to require proof of the liability of the Sellers to pay the amount before paying the aforesaid guaranteed amount to the Purchaser.

13. The Sellers and the Purchaser will be at liberty to vary and modify the terms and conditions of the said agreement without affecting this guarantee, notice of which modifications to the Guarantor is hereby waived and the same shall be deemed to have been done with the assent of the Guarantor.

14. Notwithstanding anything herein before above contained, the liability of the Bank under this Guarantee shall be restricted to Rs. _____ being the amount of advance payment extended by the Purchaser to the Seller and the Guarantee shall remain in force upto and including.

15. BG shall remain valid for 90 days after completion of supply of plant and machinery.

16 This Bank Guarantee shall be revalidated automatically till the entire completion of supply of plant and machinery.

IN WITNESS WHEREOF we have set our hands and seal hereunder at this _____ day of _____ at _____

Witnesses: For and on behalf of the Guarantor

Note :

a. Bank Guarantee should be on Rs. 100/- Non-Judicial Stamp Paper.

b. Stamp Paper to be purchased from the Rajasthan State Government in the name of the bank issuing the Bank Guarantee.

ANNEXURE VI

BG – III

PERFORMANCE SECURITY-II FORMAT

Proforma of Bank Guarantee for Satisfactory Completion of Contract

(5% of the contract price)

[To be submitted as per clause 19.2.5)

Bank Guarantee No._____

The General Manager,
Rajasthan State Ganganagar Sugar Mills Ltd.,
4th Floor, Nehru Sahkar Bhawan,
Bhawani Singh Road,
Jaipur, Rajasthan.

1. WHEREAS Rajasthan State Ganganagar Sugar Mills Ltd., a Company incorporated under the Companies Act, 1956, having its Registered Office at **4th Floor, Nehru Sahakar Bhawan, Bhawani Singh Road, Jaipur -302006 (Rajasthan)** (Hereinafter referred to as the "Purchaser" which expression shall unless repugnant to the context include its successors, executors administrators, legal representatives and assigns) is setting a 1500 TCD Expandable to 2500 TCD Sugar Plant with 4.95 MWH Bagasses based Co-Generation Power Plant on turnkey basis at Chak – 23 'F', Kaminpura, Tehsil – Srikaranpur, Distt. Sriganganganagar - 335001 (Rajasthan).

2. WHEREAS (name and address of the Sellers) (hereinafter called 'The Sellers' which expression shall unless repugnant to the subject or context include their legal representatives, administrator, successors or permitted assignees) has entered into with the Purchaser a Contract dated _____ (hereinafter called the said Agreement) for Satisfactory Completion of whole (Contract and Equipment) in accordance with the terms and conditions therein contained (hereinafter referred to as 'the said Plant and Equipment).

3. AND WHEREAS in conformity with the provisions of clause _____ of the said contract, the seller has agreed to furnish a Bank Guarantee for an amount of Rs. _____ for the faithful execution of the contract upto satisfactory performance as per PERT Chart under delay **clause 15** of 1500 TCD Expandable to 2500 TCD Sugar Plant with 4.95 MW Bagasses based Co-Generation Power Plant complete in all respects and on satisfactory performance of plant & machinery for two consequent crushing seasons in all respect as per Annexure XVIII and Annexure III after successful trial season and satisfactory performance of co-generaton power plant for two years (atleast 236 days in each year) or 24 months from successful commissioning as per terms of the contract.
AND WHEREAS the Purchaser has agreed to accept a Bank Guarantee of Schedule Bank for Rs_____ from seller of having its Head Office at _____ through its Branch _____ (hereinafter referred to as "the Bank" which expression shall unless repugnant to the context include its successors and assigns) Representing 5% of the contract price (including taxes,duties etc as quoted) against for the faithful execution of the contract and equipment.

4. In consideration of the above, the Bank hereby unconditionally and irrevocably guarantees and undertakes as a direct responsibility, to pay to the Purchaser on demand any and all moneys payable by the Seller on account of Performance Security extended

by the Purchaser to the Seller without any demure, reservation, recourse, contest or protest and/ or without reference to the Seller.

5. Any such demand made by the Purchaser on Bank shall be conclusive and binding notwithstanding any difference between Purchaser and the Seller or any dispute pending before any court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee herein contained and this guarantee shall continue to be enforceable till the Seller discharges its obligation under the contract.

6. The decision of the Purchaser as to whether the Seller has fulfilled its obligation or not towards set-off of advance payment extended by the Purchaser to the Seller shall be final and binding on the Bank and the Seller.

7. The Purchaser shall have the fullest liberty without affecting in any way the liability of the bank under this guarantee from time to time extend the time for performance of the contract by the Seller. The Purchaser shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Seller, and to exercise the same at any time in any manner, and either to enforce or to forebear to enforce any covenants contained or implied in the Contract between the Purchaser and the Seller or any other course of remedy or security available to the Purchaser. The bank shall not be released of its obligations under these presents by any exercise by the Purchaser of its liberty with reference to matter aforesaid or any of them or by reason of any other act or forbearance to other acts of omission or commission on the part of the Purchaser of any other indulgence shown by the Purchaser or by any other matter or thing whatsoever which under the law would, but for this provision, have the effect of relieving the Bank.

8. The bank also agrees that the Purchaser at its opinion shall be entitled to enforce this guarantee against the Bank as a principle debtor, in the first instance without proceeding against the Seller , and notwithstanding any security or other guarantee that the Purchaser may have in relation to the Seller's liabilities.

9. This guarantee shall be valid for a period of _____ months from _____ i.e. upto _____ and shall be revalidated automatically till satisfactory completion of contract and satisfactory performance of plant & machinery of 1500 TCD Expandable to 2500 TCD Sugar Plant with 4.95 MW Bagasses based Co-Generation Power Plant complete in all respect on satisfactory performance of plant & machinery for two consequent crushing seasons in all respect as per Annexure XVIII and Annexure III after successful trial season and satisfactory performance of co-generaton power plant for two years (atleast 236 days in each year) or 24 months from successful commissioning as per terms of the contract mentioned at **clause 19.2.5** of Terms of Payment. The Guarantee herein contained shall be a continuing Guarantee and shall not be affected by any change in the constitution of the Bank or be affected by the any other security now or hereafter held by the Purchaser and Purchaser at its discretion and without any further consent from the Bank and without affecting the liability of "the Bank" and other indulgence to or make other arrangements with the Seller and nothing done or omitted to be done by the Purchaser in pursuance of any authority contained in this guarantee shall affect or discharge the liability of the Bank.

10. The Bank undertakes not to revoke this Guarantee during its currency except with the previous consent of the Purchaser in writing.

11. The Guarantor shall pay to the Purchaser on demand the sum under **Clause 4** above without demur and without requiring the Purchaser to invoke any legal remedy that may be available to him, it being understood and agreed, FIRSTLY that the Purchaser shall be the sole judge or and as to whether the Sellers have committed breach/or breaches, of any of the terms and conditions of the Agreement and the extent of loss, damage, costs, charges and expenses caused to or suffered by the Purchaser from time to time shall be final and binding on the Guarantor and SECONDLY that the right of the Purchaser to recover from the Guarantor any amount under this Guarantee shall not be affected or suspended by reasons of the fact that any dispute or disputes have been raised by the Sellers with regard to their liability or that proceedings are pending before any Court with regard thereto or in connection therewith and THIRDLY that the Guarantor shall immediately pay the aforesaid guaranteed amount to the Purchaser on demand and it shall not be open to the Guarantor to know the reasons of or to investigate or to go into merits of the demand or to question or to challenge the demand or to know any fact affecting the demand and LASTLY that it shall not be open to the Guarantor to require proof of the liability of the Sellers to pay the amount before paying the aforesaid guaranteed amount to the Purchaser.

12. The Sellers and the Purchaser will be at liberty to vary and modify the terms and conditions of the said agreement without affecting this guarantee, notice of which modifications to the Guarantor is hereby waived and the same shall be deemed to have been done with the assent of the Guarantor.

13. Notwithstanding anything herein before above contained, the liability of the Bank under this Guarantee shall be restricted to Rs. _____ being the amount of Performance Security and payment extended by the Purchaser to the Seller and the Guarantee shall remain in force upto and including.

14. BG shall remain valid for 90 days after satisfactory performance of plant & machinery for two consequent crushing seasons in all respect as per Annexure XVIII and Annexure III after successful trial season and satisfactory performance of co-generaton power plant for two years (atleast 236 days in each year) or 24 months from successful commissioning as per terms of the contract.

15. This Bank Guarantee shall be revalidated automatically till satisfactory performance of plant & machinery for two consequent crushing seasons in all respect as per Annexure XVIII and Annexure III after successful trial season and satisfactory performance of co-generaton power plant for two years (atleast 236 days in each year) or 24 months from successful commissioning as per terms of the contract.

IN WITNESS WHEREOF we have set our hands and seal hereunder at this _____ day of _____ at _____

Witnesses: For and on behalf of the Guarantor

Note :

a. Bank Guarantee should be on Rs. 100/- Non-Judicial Stamp Paper.
b. Stamp Paper to be purchased from the Rajasthan State Government in the name of the bank issuing the Bank Guarantee.

ANNEXURE VII

Contract Agreement for supply of complete Sugar plant of 1500 TCD (22 hrs. / per day) Expandable to 2500 TCD, to produce premium quality sugar, along with bagasse based Co-Generation power plant of 4.95 MW on Turnkey basis and to provide for one year technical supervision staff.

FORM OF CONTRACT

THIS AGREEMENT MADE on the day of …….…….. between **Rajasthasn State Ganganagar Sugar Mills Ltd., Jaipur - 302006** registered under the Company Act, 1956 having its registered office **at 4th floor, Nehru Shakar Bhawan, Bhawani Singh Road, Jaipur, Rajasthan,** (hereinafter referred to as the 'Purchaser'). which expression shall, unless repugnant to the subject or context include their legal representative,administration, successors or assigns Represented by Mr/Mrs.....,**Dy. General Manager(P&S), Rajasthan State Ganganagar Sugar Mills ltd, Jaipur ,Rajasthan.**

AND

M/s ....., (registered under the …….) (hereinafter referred to as the seller) having its registered office at ....., which expression shall unless repugnant to the subject or context include their legal representatives, administrators, successors or assigns represented by Mr/Mrs. ....of the Seller.

WHEREAS

The Purchaser is desirous that certain plant & equipment be designed, manufactured, supplied, erected, and commissioned by the Sellers, as specified in 'Scope of Work' and detailed Technical Specifications as per Annexure – I of Tender document (hereinafter "the Plant Equipment and Services") and has appointed _____ (Purchaser' Representative/Engineer) for the purpose thereof (hereinafter called 'the Purchaser' Representative) and has accepted the Bid by the Sellers as modified after negotiations with the 'Purchaser' in the meeting held by the RSGSM in association with their Consultants/Purchaser ……. Jaipur on .... for design, manufacture, supply, erection, commissioning and performance of those 'Plant Equipment and Services' for a sum of _____ (Contract price in words and Figures) (hereinafter "the Contract Price"). Taxes and duties at actual as applicable will be paid. Any increase/decrease of rates of taxes in Union Budget after the date of tender will be allowed as per rules and bid documents.

NOW THIS CONTRACT WITNESSETH AS FOLLOWS:

1. The contract shall consist of this 'Contract Form' and the following documents, (hereinafter referred as "Contract Documents"), all of which by this reference are incorporated herewith and made part hereof:

   a) Form of Contract/this agreement with Annexures of this Agreement
   b) Letter of Intent (LOI)
   c) Complete bid document of RSGSM with Annexures - I to XXI and corrigendums/ adendas (if any)

This contract sets forth the entire contract and agreement between the parties pertaining to the design, manufacture, supply, erection, commissioning and performance of the plant and equipment and for providing supervision staff for one year operation described herein and supersedes any and all earlier verbal or written agreements pertaining to the design, manufacture, supply, erection, commissioning and performance of the plant equipment and services. This contract shall prevail over all other contract documents. In the event of any discrepancy or inconsistency within the Contract Documents, then the documents shall prevail in the order listed above.

2. In consideration of the payments to be made by the purchaser to the sellers as hereinafter mentioned, the sellers hereby covenants with the purchaser to design, procure, supply, supervision, erection and commissioning of the plant, machinery, equipment and services by the Bidder. (As per PERT Chart calculated from the date of signing of Agreement/ Contract) and to remedy defects therein in conformity in all respect with the provisions of the Contract.

3. The Purchaser hereby covenants to pay the seller, in consideration of the design, supply, erection and commissioning of the plant equipment and services and the remedying of defects therein, the contract price (the Excise Duty and CST are payable on actual basis on production of proof of payment thereof by the seller) or such other sum as may become payable under the provisions of the Contract, at the times and in the manner prescribed in the contract.

4. Any notice under this Contract shall be in the form of letter of fax, Notices to either party shall be given at such address as such party shall specify from time to time by written notice to the other. In the absence of such notice to the contrary, notice to the purchaser shall be properly addressed to:

SIGNED, SEALED AND DELIVERED

For and behalf of party of first part
Director In-Charge, Rajasthan State Ganganagar Sugar Mills Ltd., Head Office, Jaipur

In the presence of witness:
1. _____
   _____
   _____
2. _____
   _____
   _____

_____(Name)
_____ (Designation)

SIGNED, SEALED AND DELIVERED
For and behalf of Seller by person duly authorized

In the presence of witness:
1. _____
   _____
   _____
2. _____
   _____
   _____

_____(Name)
_____ (Designation)

ANNEXURE VIII

PROFORMA 'A'

(THIS PRICE BREAK-UP SHOULD NOT BE SUBMITTED AT THE TIME OF BID, IT SHOULD BE SUBMITTED WITHIN 60 DAYS FROM L.O.I.)

PRICE BREAK-UP OF PLANT & MACHINERY

S.No.	Particulars	Amount in Rs.	
		In Figure	In Words
I	One milling plant		
	1. Cane Unloader 2. Cane Carrier & rake carrier with drives. 3. Cane Kicker/Chopper 4. Cane fibriser and leveller 5. Mills 6. Mill A.C. VVVF Drives & panel 7. Planetary Gear Boxes & Rope coupling. 9. Mill House Crane and Gantry 10. Imbibition Equipment 11. Bagasse Elevator, Conveyor & RBC		
	Sub Total		
II	Clarification plant		
	12. Juice Weighing Scale 13. Juice Heaters 14. Juice Sulphiter 15. Sulphur Furnace 16. Air Compressor 17. Milk of Lime Preparation 18. Clarifier 19. Vacuum Filter 20. Plate heater		
	Sub Total		
III	**Evaporation and Boiling Plant**		
	21. Syrup Sulphitation Unit 22. Syrup & Molasses Storage Tanks 23. Evaporator 24. Vacuum Pans 25. Seed Crystallizer 26. Vacuum Crystallizer 27. Condensors 28. Injection water pumps Including priming pumps 29. Spray and priming pumps 30. Spray piping and nozzels etc./ Cooling tower 31. Brass/ S.S. tubes for: a) Juice heaters b) Evaporator c) Pans		
	Sub Total		
IV	Cooling, Curing & Grading Plant		
	32. Air cooled crystallizers 33. Water cooled crystallizers 34. Vertical continuous crystalliser 35. Centrifugal Machines with Staging magma mixers etc. 36. Sugar Melter 37. Grass Hoppers		

	38. Sugar Grader 39. Sugar Elevator 40. Sugar Weighing Machine 41. Molasses Weighing Machine		
	Sub Total		
V	Steam Generating Plant		
	42. Boilers 43. Chimney 44. Boiler Feed Water Tank & De-aerator, De- aerated water tank. 45. Boiler Feed Water Pumps (Electric Drive) 46. Boiler Feed Water Pumps (Steam Drive) 47. Transfer Pumps		
	Sub Total		
VI	Power Generating Plant/Cogeneration		
	48. Turbo-alternator Set with Control Panel 49. Crane with Gantry 50. Electrical main distribution boards, Cables, capacitors, MCC etc. 51. Diesel Set. 52. Interfacing/Switchyard and all accessories.		
	Sub Total		
VII	Instrumentation & Control System		
	53. Boiler Instrumentation & Control System 54. Complete mill control system. a) Automatic Cane feed device b) Mill House Turbine Control panel. c) Water Weighing & Control system. 55. Boiling House Automation a) Film type Sulphur Burner. b) Syrup Sulphitation unit c) Automation for batch pan and continuous pan, juice flow stabilizer system, water, juice and molasses weighing system. d) Evaporator Control System e) Condensate Water Control System f) Centrifugal Control System 56. General Measuring Instruments of plant.Pressure, Temperature, flow) 57. Automatic Pressure Reducing & De-Superheating stations. 58. All DCS or PLC/SCADA control system. 59. Mechanical Part of E.T.P. 60. Machinery for workshop 61. Electrical fitting/lighting and street lighting.		
	Sub Total		
	Grand Total		

Annexure – IX

LIST OF SUPPLIER OF COMPLETE SUGAR PLANTS And CRITICAL EQUIPMENTS APPROVED BY NCDC

1. M/s. Thyssen Krupp Industires India Ltd., Pimpri, Pune – 411 018.
2. M/s. Binny's Engg. Ltd., Post Box no. 111, Meenambakkam, Chennai – 600 061.
3. M/s. Indian Sugar & General Engg. Corporation, A-4, Sector – 24, Noida – 201 301, Uttar Pradesh.
4. M/s. National Heavy Engg. Coop. Ltd., 16, Mahatma Gandhi Road, Pune – 400 001.
5. M/s. Texmaco Limited, Balgharia Road, Kolkatta - 700 056.
6. M/s. Triveni Engg. & Industries Ltd., B-196, Okhla Industrial Area, Phase-I, New Delhi.
7. M/s. Walchandnagar Industries Ltd. (Marketing Division), Walchand House,15/1/B2, G.A. Kulkarni Path, Kothrud, Pune-411038.
8. M/s. A.T.V. Projects India Ltd., D-8, MIDC, Street No. 16, Marol, Andheri (E), Mumbai – 400 093.
9. M/s. Uttam Industrial Engineers Pvt. Ltd., Ghaziabad, A-8, Meerut Road, Industrial Area, Ghaziabad – 201 003.
10. * M/s. FCB-KCP Limited, Ramakrishna Building, 2, Dr. D.V. Cherian Crescent, Chennai – 600 105.
11. M/s. S.S. Engineers Ltd., J-179, MISDC, Bhosari, Pune – 411 026 (Maharashtra).
12. M/s. Kay Bouvet Engg. Pvt. Limited, B-54, MIDC Area, Satara, Maharashtra.
13. * M/s. Sitson India Pvt. Ltd., W-76, MIDC, Phase-II, Dombivli (East), Distt. Thane, Maharashtra.

* Registration is provisional and valid upto the date given in parenthesis with the name of the firm and will be confirmed after review of the performance of two equipments supplied by the firms. If the registration is not got confirmed before the specified date, the same would stand automatically cancelled. These firms would not be debarred from quoting till the provisional registration.

MILLS

ISGEC/ TEIL/ THYSSEN KRUPP IND. / WIL/ NHEC/ S.S.ENGINEERS/ KAY BOUVET/ MERU INDUSTRIES/ ALARD INDUSTRIES**/ SAISIDHA / SITSON**(One Mill) (15.04.2011)/HI-TECH ENGG CORPORATION (23.4.2012)*/UTTAM

TWO ROLLER MILLS

ULKA ENGINEERS PVT. LIMITED

BOILERS

IJT/ THYSSEN KRUPP IND. / NHEC/ TEXMACO/ LIPI / WIL/CETHER/ SITSON/ S.S.ENGINEERS/ SUPER STEAM BOILERS ENGINEERS PVT LTD./ CHEEMA BOILERS*(17.02.2012) / HI-TECH ENGINEERS AHMEDNAGAR*(20-1-2012)/MERU INDUSTRIES/ THERMAX/SUPER STEAM BOILER.

TURBO-ALTERNATORS

a) **TURBINE** – APE BELLIS/ TEIL/ BHEL/ ALSTOM POWER INDIA LTD.,(FOR SINGLE AND MULTI-STAGE TURBINES) / KESSEL/ SITSON **(One Turbine) (15.04.2011) / KIRLOSKAR EBARA PUMPS *(22-10-2011)

b) **ALTERNATOR** – JYOTI / KIRLOSKAR/ BHEL

CENTRIFUGAL MACHINES

a) **CONTINUOUS** – NHEC/ WIL/ THYSSEN KRUPP IND./UTTAM

b) **BATCH TYPE** – NHEC/ WIL/ THYSSEN KRUPP IND./ PORT/ FCB-KCP / UTTAM*(17.02.2012)

CLARIFIERS

DORR OLIVER/ TEIL/ INTECH/ SIMPLEX/ JORD/ UNIVERSLA HEAVY ENGG.(SHAHARANPUR)

VACUUM FILTERS

DORR OLIVER/ TEIL/ INTECH/ SIMPLEX/ JORD/ UNIVERSAL HEAVY ENGG. (SHAHARANPUR)

TRANSMISSION GEARS

ELCON/ FMG/ TEIL/ WIL/ NEW ALLENBURY/ SHANTHI/ GREAVES / KAVITSU*(UPTO 750 HP) (20-01-2012)/UTTAM

PRESURE FEEDERS

a) TRPF-BABAVISHWAKARMA/ S.S. ENGINEERS / NHEC / WIL / MERU/ SAISIDHA / STAR APPLIED MECHANICS (23.4.2012)*.
b) GRPF-S.S.ENGINEERS/ TEIL/ NHEC/ WIL/ MERU/ KAY BOUVET ENGG. PVT. LTD. / SAISIDHA / STAR APPLIED MECHANICS (23.4.2012)*/UTTAM

* Registration is provisional and valid upto the date given in parenthesis with the name of the firm and will be confirmed after review of the performance of two equipments supplied by the firms. If the registration is not got confirmed before the specified date, the same would stand automatically cancelled. These firms would not be debarred from quoting till the provisional registration.

** The firm has been registered provisionally for supply of one mill/milling tandem/ Turbine only. The provisional registration for supply of more equipments would be given only after review of performance of first equipment.

Annexure X

LIST OF APPROVED SUPPLIERS OF IMPORTANT EQUIPMENTS APPROVED BY NFCSF

1.	Electrical Motors (a) (AC) (b) (DC) (c) Thyrister Controls/ Intvertorfor AC/DC electric motors	 -SIEMENS/ KIRLOSKAR/ NGEF/ JYOTI/ GEC/ CROMPTON/ BHARAT BIJLI/ ABB/ INTERNATIONAL COMBUSTION (Geared Motors)/ LUXMI HYDRAULICS./ HINDUSTAN MOTORS (upto 120HP)/ POWER BUILD / ELECON/GEARS LTD. (Geared Motors)/ RAJENDRA (UPTO 50 HP ONLY) SHREE N.M. ELECTRICALS LTD (SIMO) MOTORS -CHINA/KIRLOSKAR BROTHERS / INTEGRATED ELECTRIC -KIRLOSKAR/INTEGRATED ELECTRIC CO./ CROMPTON GREAVES / TRIDENT POWERCRAFT -SIEMENS/ L&T/ KIRLOSKAR/ ABB/ GEMCO/ BHARAT BIJLI/ CONTROL TECHNIQUES/ HI-REL ELECTRONICS PVT. LTD./ DAN FOSS INDUSTRIES (P) LTD./AMTECH Electronics /PARKER HANNIFIN/ CROMPTON GREAVS
2.	Centrifugal Pumps (a) Vacuum Pumps (b) Pumps (other than Boiler Feed) (c) Boiler Feed Water Pumps	 -KAKATI/ VACUNAIR/ ACMEVAC/PPI/ KIRLOSKAR/ TRIVENI/ MANEK LTD./ GARUDA/ USHA COMPRESSORS -KSB/KIRLOSKAR/BEACON WEIR/JYOTI/MATHER &PLATT /GITA /KISHORE /SULZER /VOLTAS/ SINTECH/PRECISIOIN PRODUCTS LTD/JOHNSON FLOW MORE PVT. LTD./ SAM TURBO INDUSTRIES -KSB/KIRLOSKAR EBARA/SULZER
3.	Brass Tubes	ALCOBEX/ MULTIMETALS/ ORDINANCE FACTORY KATNI/ SURESH METALS/ INDOSWE/ GUJARAT CYPROMAT / CUBEX / MORKHIA/ INDOFAB/ MEHTA TUBES / ACCENT METALS / METALS ALLOYS/ AISHLONI.
4.	Weighing Machine	a) Sugar – AVERY b) Checkwigh - AVERY/ ATLAS/ FRANCIS KLEIN/ BHARAT/ PRECISION/ AVON/ ASSOCIATED SCALES COMPANY.
5.	Stitching Machine	JUKIE/ STITCHWELL/ QUALITEX/ SINGER.
6.	Mills, Boiler Feed Water & Fibrizer Turbines	APE BELLIS/ TEW/GUJARAT PRIME MOVERS
7.	Magma & Molasses Pumps	SPAN/ RAVALGAON/ GITA/ YESHWANT/ IND.ENGG. CORPORATION/ KAY IRON**/ PUMP INDIA/ ALPHA/ ROTO/ SYNO/ ROTOMAC/ JOHNSON/ HYDRO PROKAV
8.	Cane Unloader	ACME (KHANDELWAL)/ TECHNOCRAFT/ PHEW/ KAY IRON/ ISGEC/ SIKAINTER PLAST**/ CRANES & STRUCTURALS/ SIMPLEX/ UTTAM/ EXTRACT/ TEXMACO/ RACHITECH/ ANUPAM ENGG./ AUTOMECH/ SHIPRA/ SAISIDHA
9.	Feeder Table	ACME(KHANDELWAL)/ TECHNOCRAFT/ PHEW/ KAY IRON/ ISGEC/ SIKAINTER PLAST**/ CRANES & STRUCTURALS/ SIMPLEX/ UTTAM / SAISIDHA
10.	Cane Carrier & Feeder Table variable drive	GREAVES COTTON/ DYNASPEDE/ SERVODRIVE/ DYNODRIVE/ POWERMAG CONTROL SYSTEM PVT. LTD.

11.	Air Compressors	SLM MANEKLAL/ INGERSOLL RAND/KHOSLA/ KIRLOSKAR/ CP TOOLS/KAY INTERNATIONAL/ KULKARNI (Rotary)/ ELGI/ TRIVENI/ MANEK LAL/ USHA COMPRESSORS/ IWAT MOTHER SONS
12.	Diesel Set	Diesel Engine: MWM/ CUMMINS/ KIRLOSKAR/ GMMCO (INTAC) / POWERICA / HINDUSTAN POWER PLUS. Alternator : JYOTI/ KIRLOSKAR/ NGEF/ CROMPTON/ G.G. NEWAGE (STAMFORD)
13.	Enclosed Worm Gear Boxes	ELECON/ RADICON/ NEW ALLENBERRY/ SHANTI/ CPEC/ ESSENTIAL.
14.	HP Steam Valves	BHEL/ FOURESS/ DEWRANCE MACNEILL/ L&T/ KSB/ BV VALVES/ MAZDA/ NECO/DARLING MUSECO (SAFETY VALVES)/ SKILT/ LEADER/ CRESCENT/ UNI KLINGER/ECONO/BDK PROCESS CONTROLS/ TYCO SANMAR (RELIEF VALVES)/ FAINGER LESER (RELIEF VALVES)/ FLUIDLINE/ CONTINENTAL (Control Valves)/ UNITED ENGG. /NETA VALVES/ STEEL STRONG VALVES
15.	Electric Cables	GLOSTER/ CCI/ ICC/ UNIVERSAL/ POLYCAB/ FINOLEX/ VICTOR (PVC/XLPE)ALCON/ INDUSTRIAL CABLES/ KEI/ ELECTRIC CABLES INDUSTRIES/ DASHMESH/ HAVELL'S INDIA/ RPG(earlier ASIAN CABLES)/ GUPTA ELECTRIC/ GRANDLAY/DIAMOND/RAVIN/CREST/ROLLEX/ CHANDRESH CABLES LTD./ SRIRAM CABLES/DELTON CABLES/ MAYUR ELECTRICAL/RALLISON ELECTRICALS PVT. LTD.
16.	Instruments for Boilers	TAYLOR/ BELLIS CONTROL/ JN MARSHALL/ DATE PROCESS(PROCON)/ ROSE MOUNT/ ENCARDIO-RITE/ NIVO-CONTROL.
17.	Centrifugal machine timers	IMPORTED/ WIL/ L&T/ AG ENGG/ DIGHE
18.	Steam Pressure reducing & desuper heating station	JN MARSHALL/ APE BELLIS/ MAZDA/ TAYLOR/ SATWIK ELECTRIC/ DEWRANCE MACNEILL/ VISHWA/ MIL CONTROLS (CONTROL VALVES ONLY)/ CHEMTROL ENGG./VRL
19.	Stainless Steel Tubes	RATNAMANI/ HEAVY METAL (EARLIER RELIABLE)/ APEX/ PRAKASH STEELAGE/ RAJENDRA MECH. INDUSTRIES/ QUALITY/ VISHAL/ LEELA TUBES / DIVINE TUBES / SHUBLAXMI METALS & TUBES / SCORODITE/ MAXIM / ARVIND PIPES & FITTINGS / DHIRAJ INDUSTRIES / SLS TUBES / MODERN TUBES / HINDUSTAN INOX./ BHANDARIFOILS
20.	Switch fuse Units	GEC POWER CONTROL/ L&T/ SIEMENS/ STANDARD ELEC.LTD./ CONTROL & SWITCHGEAR / ELECTRIC CONTROL GEAR/ HAVELLS INDIA/ HPL-INDIA (LK-HPL BRNAD)/ SCHNEIDER ELE.INDIA PVT. LTD./ INDO ASIAN FUSEGEAR/ CRYSTAL/ SG CONTROLS
21.	Air Circuit Breaker & Contactor & Relays	GEC POWER CONTROLS/ L&T/ SIEMENS/ NGEF/ MEI/ KIRLOSKAR SYSTEM LTD., BANGALORE/ CROMPTON GREAVES/ BHARTIYA CUTLER HAMMER/ TELEMECANIQUE (for contactors only)/ CONTROL & SWITCHGEAR/ ANDREW-YULE/ ROCKWELL (UPTO 72 AMPS.)
22.	Sulphur Burners (a)Manually Controlled (b) Automatic	a) SARAN/ KAY IRON/PORT ENGG./ KAMAL/ RAVALGAON/ ORIENTAL ENGG./ SATWIK b) DIGITAL UTILITY/ AJRI ENGG./ SATWIK/ VISHWA.
23.	CI Valves (Sluice, Globe & non-return)	KIRLOSKAR/ KILBURN/ CALSENS/ CRESCENT/ VENUS/ FOUNTAIN/ GIRNAR/ LEADER/ AUDCO/ DH BROTHER/ DEWRANCE MACNEILL & CO./ BISHNU/ PARUI/ UPADHYAY VALVES**/ AV ENGG. WORKS/ FLUIDLINE/ PELICAN /SHREE BALAJI/ H.SARKAR/ DURGA/JUNEJA METAL /AVISHKAR/ KEJRIWAL/ STEAM & MINING/ PATSON/ BDK PROCESS CONTROLS/ THORAT/INDIAN VALVE INTERNATIONAL/ CONTINENTAL (Butterfly)/ VALCRAFT (Butterfly)/ UNITED ENGG./ BARMECHA/

		KALPANA/ SONDHI INDUSTRIES/ CRANE PROCESS (SAUNDERS & BUTTERFLY) / NETA VALVES / PURI INDUSTRIES/ V.A.VALVES.
24.	Turn Key Boiling House	ALL COMPLETE PLANT SUPPLIERS/ KAY IRON/ INDL. ENGG./ VIKRAM PROJECTS/ SARAN/ EXTRACT/ EUREKA/ SURYATRONICS/ VIDIANI**/ SHRIJEE ENGG./ ALARD/ ACROW INDIA/ SIDHARTH TANKS/ UTECH ENGG. WORKS PVT LTD/SAISIDHA/ BABA VISHWAKARMA ENGG. (P) LTD./ SHAMRAJ ENGG. WORKS / HI-TECH ENGINEERING CORPORATION/ UTECH ENGINEERING WORKS (INDIA) PVT. LTD./ STAR APPLIED MECHANICS / R.R. HEAVY ENGINEERING/ VRL AUTOMATION
25.	Automatic Sugar Weighing & Bagging	JASSUBHAI/ RICHARD/RIEF MIDWAY/ BEL**/ NITIRAJ (ELECTRONIC)/ R.K. ENTERPRISES/ POWER BUILT
26.	G.M. Valves	ZOLOTO(ISI mark only)/ LEADER/SANT VALVES / PUNJAB METAL WORKS/ NETA VALVES
27.	Micro Processor based Control System (Automation)	DCM Data Products / VRL AUTOMATION
28.	Hydro pneumatic Accumulators	EPE/ HYDACHYCOM (IND) PVT. LTD.
29.	Plate Type Heat Exchanger	PRAJ INDUSTRIES/ ALFA LAVEL/ INDSWEP/ INDIAN DAIRY MACHINERY CO./ TRANTER
30.	Conveyor Chains	LAL BABA/ SWAJIT/ ROLCON/ GEE ESS/ SIJ/ TECNO- RACK ENGG./ LG BALAKRISHNAN/ RAJ AMAR
31.	Soft Starters	JAYSHREE/ CONTROL TECHNIQUES
32	EOT/HOT Cranes	HEBENKRAFT (EOT & HOT)
33.	Ball Bearings	AUSTIN ENGG.
34.	Planetary Gear Box	DYNASPEDE INTEGRATED / TOP GEAR TRANSMISSION / KAVITSU TRANSMISSION
35.	Distillery/Ethanol/ - Biocomposting & Effluent Plants	PRAJ/ THYSEEN KRUPP**/NHEC**/NARANLALA / ALCO-TECH / MOJJ ENGINEERING SYSTEMS / - TRIOCHEM TECHNO LEGAL SERVICE / UNIVERSAL FORCES INDUSTRIES / KBK Chem
36.	Air heater tube	M/S. KHANNA INDUSRIAL PIPE (PVT.) LTD.
37.	Condensing and cooling system	M/S. SHAMRAJ ENGG. WORKS
38.	Evaporator drying, system for distillery, effluent plant	M/S. SSP (PVT.) LTD.
39.	Refinery on Turn Key Basis	M/s. Shrijee Engg. Works / Utech Engineering Works
40.	Power Transformer	M/s. Emco Ltd.

Annexure XI

MAKE OF INSTRUMENTS & ACCESSORIES USED IN AUTOMATION SYSTEMS

Sr.No.	Item	Make
	Sensors	Yokogawa, Emerson (Rosemount) ,HONEYWELL
2.	Transmitters (Pressure, Level, Temperature & Mills)	Emerson (Rosemount), Yokogawa, ABB, Honeywell
3.	Magnetic & Mass Flow Meters	E&H, Khrohne Marshall, Yokogawa (Rosemount), Honeywell
4.	Indicators & Totallizers	VRL, Yokogawa, Masibus
5.	Auto- Manual Stations	VRL, Masibus, Manas
6.	Signal Isolators	VRL, Masibus, Manas
7.	Alaram Units	VRL, Procon, Mesibus
8.	Controllers	Yokogawa, Siemens, Honeywell
9.	PLC/DCS System	Siemens, Messung, Honeywell (ML Series)
10.	High ended DCS System with stand-by Communication Redundancy.	Siemens, Yokogawa (AS10D with centum VP), Emesson, Honeywell (C70R with experion HS/LS)
11.	AC Variable Frequency Drives	Siemens, Eurotherm, Schneider, Emerson
12.	DC Drives	Eurotherm, Siemens, Control techniques
13.	Recorders	Yokogawa, VRL, Fobmarshall, Honeywell
14.	Data Loggers/ Scanners	VRL, Massibus, Procon, Honeywell
15.	I/P Converters	MTL, ABB, Emerson(Rosemount), Control Air (USA)
16.	Air Filter Regulators	Shavo Norgren, Janatics
17.	Control Valves	R.K. Control, MIL Control, Dembla
18.	Pressure Reducing Valves	R.K.Control, Penucon, Dembla
19.	Safety Valves	Darling Muesco
20.	Isolating & Bypass Valves	KSB, Leader
21.	Power Cylinders	R.K.Controls, Electro-Pneumatic, Rotex
22.	Solenoid Valves	Rotex, Schrader-Duncan, Precision
23.	Magnetic Flow Meter	Emerson (Rosemount), Honeywell
24.	Air Compressors	Ingersoll-Rand, Elgee
25.	Air Dryers	Gem, Southwest Compressors
26.	Mass Flow	Emerson (Rosemount), ABB, Honeywell
27.	Personal Computers	HP, IBM, Compaq
28.	Printers	HP
29.	UPS	American Power Corporation, Emerson, Hirel
30.	Cables	Finolex, CCI
31.	Absolute Pressure/ Temperature gauges	GENERAL/WAARRE/WICA
32.	System Houses	VRL/R-Tech/MICON

Note for Ann. XI & XII –

(The Supplier should make all possible efforts to minimized the Nos. of Makes of similar items of auxiliary equipments such as pumps, motors, starters, switch gears, air compressors instrument etc. etc. for better control by purchaser on store inventories and facilitate availability of spars and after sale services.)

ANNEXURE XII

PERFORMANCE CERTIFICATE

This is to certify that M/s_____have supplied, erected and commissioned plant and machinery having crushing capacity_____commissioned on date_____and following performance have been executed for last five years.

1. Capacity utilization (including stoppages)
2. P.I.
3. R.M.E. at_____
4. Macerration % cane
5. Pol % Bag
6. Moisture & bagasse
7. Evaporation achieved by Evaporator set
8. Vacuum Pan - Cycle time for A,B,C massecuite
9 . Condenser: - Water consumption/kg of vapour
10. Minimum temp. dropped by spray system
11. Sugar quality produced - colour moisture
12. Steam generating plant

Generative	TPH
CO2 %	
Flue Gas temp. at ID Fan	
Thermal of the boiler	
Power, Generating Plant	
Installed capacity	
P.F.	KW
Max. load	kg/kw/hr
Stroppages	% Mechanical
	% Electrical
	% No cane

This is to certify that the performance of the plant and machinery working in general is satisfactory.

(This Certificate should be issued by Competent Authority of That Plant)

ANNEXURE XIII

LETTER OF AUTHORITY

To

(Name of Purchaser)

Whereas _____ (Name of Sellers giving authorization) are established and reputable manufacturers of Sugar Plant and Machinery having factories at _____ (address) and are submitting our bid for the above, do hereby authorize _____ (Name & designation) to represent us and submit the bid and subsequently negotiate and sign the contracts with you against Tender No. _____ (Assign No.) for the above plant equipment manufactured by us.

We hereby extend our full guarantee and warranty as per **clauses …….. to …….** of Terms and conditions of contracts for the plant equipment offered for supply by us against this Invitation for Bid.

(Signature for & on behalf of Sellers)

Note :

1. This should be signed by a person competent and having power of attorney of the Sellers. It should be included by Seller in its Bid.
2. In case of a company the copy of Board resolution in this regard and in other case a copy of duly executed authority should be enclosed.

Annexure XIV

INSPECTION PROCEDURE OF SUGAR PLANT AND MACHINERY

1.0 GENERAL

1.1 Whenever there is no particular reference in the agreement about IS/ISO Standards, the equipments/units should be manufactured/fabricated strictly in accordance with Latest IS/ISO Standards.

1.2 Inspection at Manufacturer's workshop prior to dispatch

The list of machinery and equipment to be inspected by the constituted committee authorized by Director-In-Charge keeping concerning member of Technical Consultant N.F.C.S.F. - Delhi, at manufacturer's works prior to dispatch is furnished in enclosed **Annexure XV**. The inspection call from OEM/Sub-Vendor should be enclosed with Internal Inspection Report duly signed by Sub-Vendors authorized person and OEM's representative.

1.3 **Items which do not require pre-dispatch inspection**
The list of machinery and equipment which do not require pre-despatch inspection is furnished in enclosed **Annexure-'XVII'**.

1.4 During the course of inspection at manufacturer's workshop, the manufacturer will make available the following test certificates in respect of raw material for verification.

Material Test Certificate giving chemical composition, physical properties such as ultimate tensile strength, Elongation %, yield strength, hardness of finished product etc. in respect of steel forgings, steel castings, boiler drums and tubes, brass tubes, stainless steel tubes steam piping and valves, components of conveyor chains, gun metal parts of mills, C.I. shells for mill and GRPF roller/underfeed roller, drive and driven shafts of various equipments, various components of turbines, baskets and shafts of centrifugal machines, enclosed gear boxes and alternator etc.

1.5 At the time of inspection, the manufacturer will provide, free of cost, instruments, measuring devices such as straight edge, micrometers, DP test chemicals, line dori, verniers, calipers, 'GO' and 'NO GO' gauges, hardness tester, ultrasonic testing instrument, stroboscope, vibration meter, noise level measuring instrument, dial gauge, feeler gauge, drift expansion/flattening test facility for various tubes, breaking load test and hydraulic test facility or any other instrument or test facility as may be required.

1.6 For Electrical Items, the manufacturer will provide, free of cost, the instruments such as Secondary Injection Kit, High Voltage Testing Instrument, Megger, Kelvin bridge, Vibration meter, Stroboscope, Phase sequence tester, Voltmeter, Ammeter, or any other instrument or test facility as may be required.

1.7 Chains for cane carrier, rake carrier, rake type intermediate carrier, feeder table, bagasse elevator, bagasse carrier, cross carrier, RBC etc. As per latest IS 8465& I.S.-8466 – Inspection will be carried out by NFCSF on samples drawn at random for dimensions , break loading test, measurement of hardness for pin, bush, roller etc. cumulative pitch verification 0.025 percent of nominal chain length of 3000 mm and fabrication and welding quality & chemical composition and test report for each component .

1.8 Cane Carrier, auxiliary carrier, rake type intermediate carrier, bagasse elevator, bagasse carrier, RBC and cross carrier.

- ❖ Dimension verification of structure, fabrication and welding quality will be inspected.
- ❖ Dimensional checking of assembled drive and driven shafts with sprockets, measurement of hardness of shafts, C.S. sprocket, profile of sprocket etc. Scrutiny of material test certificate for cast steel sprocket, Drive and Driven Shafts etc.
- ❖ Witnessing ultrasonic testing of drive and driven shafts.

1.9 For Stainless Steel Tubes, Brass tubes and boiler tubes, following inspection shall be carried out by NFCSF.

(i) Dimensional checking of random samples.

(ii) Witnessing Destructive Testing of sample tubes drawn at random, for tensile strength, flattening test, flaring test, reverse bend test, elongation test, acid test as per procedure of IS:13316-1992 for SS tubes, IS 407 for brass tubes and relevant IS/BS code for boiler tubes.

(iii) Verification of material test certificates furnished by manufacturer.

(iv) Witnessing hydraulic testing of random samples of SS/brass/boiler economizer & superheater tubes.

(v) For Boiler Tubes Verification of IBR test certificates, IBR stamping and heat numbers marked on the tubes, hydraulic test certificate.

1.10 Manufacturers shall also provide dynamic balancing test certificate for high speed rotating parts, wherever required.

1.11 The Inspecting Officer of NFCSF shall be within his rights to bring to the notice of the manufacturer/sellers, any defects and deviations observed from the approved drawings/agreement specifications/standard engineering practices/relevant Indian/British/DIN/ API codes etc. and the manufacturer/Seller shall be required to rectify such defects and deviations at their own cost. Such inspection by NFCSF or its nominees shall not absolve the manufacturer/sellers from their responsibility of supplying the machinery and equipment in accordance with the terms and conditions of the agreement.

1.12 The OEM/Sub-Vendor shall arrange test motors, gear boxes for witnessing, no load running trial of their equipment.

2.0 Parameter for Inspection at Manufacturer's Works

2.1 Milling Tandem

2.1.1 Cane Unloader

- ❖ Checking up of calculations for deflection, modulus rigidity etc.for which calculations to be submitted with drawings in detail by the manufacturer prior to fabrication of unloaders/cranes.
- ❖ Stability certificate for safe working be submitted from Registered Chartered Engineer.
- ❖ Dimensional checking for bridge, viz span, camber, rail gauge, stoppers, shafts, wheel dia, brake drum dia, rope drum dia, diagonal measurement of LT wheel centers.
- ❖ Witnessing deflection test - for two motion crane with 15 T load plus two trolleys at center of the bridge. In case of 3 motion crane load of 7.5 T plus one trolley a the center of the bridge or in case of two trolleys on one bridge of 15 T plus two trolleys at centre.
- ❖ Water level check of bridge for camber.
- ❖ Checking up of components like motor, gear box and service factor, brake thrustor, pulleys, grab, starters, relays, S.F. units for make, duty parameters etc.
- ❖ Witnessing no load running and LT shaft and trolleys drum etc. for checking of L.T. speed, by counting speed of L.T., shaft revolution, C.T. and Hoist speed in terms of metres/sec., material test certificates for each components.
- ❖ Scrutiny of test certificates furnished by respective manufacturer for motor, gear box, rope etc. for its duty parameters. Testing shall be witnessed as per procedures

described in IS 3177 & IS 807 of latest amendment and for motors IS 4722-1968/325-1978.

2.1.1.1 Hydraulic Truck Tipler

Verification of dimensions,as per drawing, hydraulic system, no-load running trial of the tippler for its operation such as oil pressure, inclination of the tippler at extreme position, various. Components and its make as per agreement, and safety aspect etc.

2.1.2 Feeder Table

- Checking of various dimensions of drive and driven shafts with sprockets etc.
- Inspection of chains as per procedure detailed in **para 1.7**
- Witnessing no load running trial.

2.1.3 Cane Carrier, auxiliary carrier and rake carrier.

- Refer **para 1.7 & 1.8**

2.1.4 Cane Kicker, Chopper, Cutter, Leveller, Shredder and Fibrizer.

- Checking measurements as per manufacturer's drawings.
- Witnessing measurement of Hardness of shaft, hub, hammer, knives and anvil.
- Checking of weight of hammers and knives sample drawn at random for equal ness of weight.
- Checking assembly and static balancing for rotor assembly of kicker, chopper.
- Checking rotor assembly and witnessing dynamic balancing for fibrize leveller and cutter, with hammers and without hammers/knives.
- Scrutiny of material test certificates furnished by manufacturer of shaft, steel for hub, knives, anvil etc.
- Witnessing ultrasonic testing of all shafts.
- Checking for dimensions of bearings, plummer blocks,
- Verification of HP rating of couplings and gear box. Selection Details to be submitted and got approved prior to manufacture. of the said equipment.

2.1.5 Rake Type Intermediate Carriers

Refer **para 1.7 & 1.8**

2.1.6 Mills including pressure feeder and under feed roller.

- Checking for dimensions and clearances of mill duly assembled with head stock, wear plate, bearings, side and top caps. However, in respect of firms manufacturing mill of a particular size for the first time, the mill to be assembled along with rollers, crown pinions, trash beam , trash plate , top& discharge scrapers and Hydraulic top cap etc. at its workshop.
- Checking various dimensions for various components.
- Witnessing the measurement of hardness for cast steel crown pinion (IS:2708 Grade-III), roller shafts (IS:1570-1979), roller shells (IS:11201-1985), tail bars.
- Witnessing hydraulic testing of bearings at 5 kg/cm sq. g and top cap duly assembled with ram at an oil pressure of 350 kg/cm sq.
- Witnessing of ultrasonic testing as per ASTM level 3 for mill roller shafts, pressure feeder roller shafts, underfeed roller shafts, crown pinions and tail bars.
- Hardness and MTC for steel casting.
- Tooth profile checking with template for crown pinions.
- Checking bore with micrometer with prescribed limits and key way profile with template of full size.

- ❖ Accuracy of pitch of roller grooves and grove profile with template and matching of trash plate on feed roller.
- ❖ Scrutiny of material composition and heat treatment certificates for steel castings, forgings and fabricated beds and Verification of marking of Heat No. on various components.

2.1.6.1 Witnessing no load running trial of rotary screen assembly with its drive.

2.1.7 Mill Drives

(a) A.C drives for mills, fibrizer, shredder and feed water pump

- ❖ Witnessing the no load running trial and checking up safety system for each drive fitted with its primary gear box and forced lubrication system and direction of rotation with reference to mill layout.
- ❖ Verification of test certificates for hydraulic testing of casings, rotor material test certificates, balancing certificate of rotor, blade surface crack and verification of Heat no, Serial No. of rotor and casing of turbine etc.
- ❖ Checking blade construction and sizes as per data sheet.
- ❖ Measurement of vibration in terms of amplitude, velocity, frequency and acceleration, noise level as per latest standards.
- ❖ Open inspection of turbine and gear box – to examine the condition of rotor, bearings, tooth contact of gears, back lash, hardness of gear, verification of service factor from catalogue and calculation with relevant standards, thrust clearance, clearance between moving and stationery blades, bearing clearance, trueness of rotor disc face i.e. Run-Out and Face-Out.
- ❖ Verification of residual unbalance after Mechanical Running Trial as per latest standards.
- ❖ Verification of characteristic curve for steam consumption versus load.
- ❖ Verification Correction Factor Chart for variation of pressure, temperature, and speed for inlet steam and exhaust steam in relation to the Design Parameters, of the Turbine.

(b) A.C. Motor and VVVF Drives for mills or pressure feeder

(i) For A.C.Motors / VVVF Drives.

- ❖ Witnessing measurement of resistances and insulation values for main and field windings: Witnessing H.V. test.
- ❖ Witnessing no load trial and full load trial for relevant standards as described in IS 4722 and BS:5000 for temperature rise of windings.
- ❖ Witnessing measurement of vibrations as per IS 12075 during running trial.
- ❖ Scrutiny of test certificate for dynamic balancing and ultrasonic testing of rotor shaft.

NOTE : Type test shall also be witnessed in respect of any new size or design of manufacture of AC motor.

(ii) For Thyrister and Control Panels:

- ❖ Testing of thyrister Panel for temperature rise as per relevant class of duty.
- ❖ Checking of functioning of various protection devices and relays.
- ❖ AC Motor
  Testing procedure with control panel as prescribed in the latest IS code.
- ❖ Hydraulic drives for Mills

Procedure to be finalized in consultation with manufacturers.

2.1.8 Planetary Gear Boxes for Mill / Pressure Feeder Drive

- ❖ Checking up of dimensions, handing and reduction ratio,
- ❖ Witnessing the no load running trial at full input speed of each gear box fitted with forced lubrication system at partial loading by damping.
- ❖ Open Inspection:
- ❖ Checking up of tooth contact and blue impressions.
- ❖ Measurement of back lash, tooth contact area, hardness of shaft and gear wheel and pinion, oil circulation system and nozzle location etc.
- ❖ Teeth surface finish checking – visually.
- ❖ Verification of material composition certificate, ultrasonic test and dynamic balancing certificate stress relieving & physical test report, for gears/pinions/shafts.
- ❖ Verification of Service Factor, H.P. rating calculations, and Pressure Lubrication System having 2 pumps, 2 motors, coolers, 2 micro filters etc.
- ❖ Routine test certificate of gearboxes.

2.1.9 Rope couplings

- ❖ Checking of dimensions as per manufacturer's drawings.

2.1.10 Bagasse Elevator & R.B.C.

As referred in **para 1.8**

2.1.11 Mill House E.O.T. Crane

Inspection and testing procedure shall be same as for cane unloader with a load as specified in the Specifications at 2.1.1 and as per I.S.807 & I.S.-3177.

2.2 BOILERS

2.2.1 Pressure Parts :

- ❖ Dimensional checking of drum, wall thickness, tube hole sizes (with go-no-go gauge), drum internals.
- ❖ Verification of material composition certificate for drum, tubes, super heater and economizer elements and tube holes size in drum, stress relieving certificate for drum, header, etc.
- ❖ Hydraulic test of headers and economizer coil and super heater coil etc.
- ❖ Witnessing destructive testing of random selected sample of boiler tubes as per **para 1.9**, and checking of tube thickness, o.d.,. and IBR stamping verification.

2.2.2 D.C. / A.C. variable frequency Motor Drives for ID/FD fans

Inspection and testing as per procedure described in **para 2.1.7** (b) in case D.C. motors and as per relevant IS code in case of A.C. motors.

2.2.3 ID/FD/SA Fans:

- ❖ Verification of impeller curvature, wear pad for ID, test certificates for dynamic balancing of impeller of ID, FD, SA fan etc. and sizes of plate s thickness etc.
- ❖ Verification of calculations for capacity and head of fans.
- ❖ Dimensional verification as per approved drawing.
- ❖ Witnessing measurement of free air delivery/capacity.
- ❖ Witnessing ultrasonic testing of shafts of fans.
- ❖ MTC for shaft, characteristic curves for fan performance etc.

2.2.4 Furnace Grate Assembly

- ❖ Dimensions of assembled frame sizes. etc.
- ❖ Operation of grate bar movement & traveling grate movement by fitting of auxiliary drive.
- ❖ Checking of grate bar hole details and hardness and MTC

2.2.5 Oil firing equipment assembly

- ❖ Running trial of the system.
- ❖ MTC, RTC and hydraulic testing certificate for individual equipment.

2.3 Clarification and Boiling House Machinery

2.3.1 Juice, Water and Molasses Weighing Scale

- ❖ Dimensional check for capacity.
- ❖ Witnessing water tipping trial of the assembly at manufacturer's site i.e. water trial and accuracy test and vibration/stability and jerk checking.

2.3.2 Juice Heaters

- ❖ Witnessing hydraulic testing of shell with doors closed, at 9 kg/cm^2.g.
- ❖ Verification of tube plate thickness, door thickness and door straightness etc. Measurement of tube plate holes size checking by go and no-go gauge, no. of holes per pass, no. of passes, lay out of passes on top and bottom covers, condensate outlet connection, noxious gas connection, juice drains, airvent connection, checking of door-tightening arrangement with T-bolt/I bolt with individual pin arrangement, Steam/Vapour entry connections , ligament, welding quality, distance between tube plates and alignment, variation pitch of holes, witnessing hydraulic testing of steam, vapour and double beat valve etc.
- ❖ Condensate outlet connection, noxious gases connection, juice drains/air vent connections, checking of steam/vapour connections.
- ❖ For plate type juice heaters, measurement of thickness of plates, size, gasket and hydraulic testing, scrutiny of material test certificate for S.S.
- ❖ Tube plate holes to be finished by reaming.
- ❖ Inspection and testing of S.S./Brass tubes shall be as per **para 1.9**.

2.3.3 Juice Sulphitation System

- ❖ Verification of dimensions, witnessing no load running trial of stirrer, checking up of volume of vessels etc.
- ❖ Checking the dimensions of juice scrubber.
- ❖ Checking of overflow level, SO_2 coil layouts and sizes, lime entry position, site glass position & its washing coil etc.
- ❖ Checking of juice entry details, hole size and thickness of partition plates.

2.3.4 SO_2 piping :

- ❖ Measuring size, witnessing hydraulic testing etc. of all piping and valves for diaphragam valves dimensional check only, MTC.

2.3.5 Air Compressors and Vacuum Pumps

- ❖ Dimensional checking
- ❖ Witnessing measurement of free air delivery with nozzle test, measurement of power consumption as described in BS: 1571 part II.

- ❖ Checking pressure setting for valves, auto cut -off, bearing temps, cooling system checking.
- ❖ Verification of hydraulic test certificate and material test certificate.

2.3.6 Milk of Lime Station

- ❖ Verification of dimensions, checking up of volume, stirrer speed and witnessing no load running trial of lime slacker and classifier stirrers etc.

2.3.7 Clarifier

- ❖ Mock-up assembly checking for quality of fabrication, of main body assembled with bottom cone and tray plates.
- ❖ Dimensional and straightness check for central shaft assembly.
- ❖ Witnessing no load running trial of drive assembly.
- ❖ Witnessing water filling test of juice and mud boxes fitted with telescopic valves.

2.3.8 Vacuum Filter

- ❖ Verification of dimension, for various components, material test certificate for S.S. material, witnessing hydraulic testing of filtrate collection tubes.
- ❖ Run out and Face out check for the drum shell and trunnion with dial gauge.
- ❖ Checking the fixining of decks and its material along SS screen fitting.
- ❖ Witnessing no load running trial at low and high speed etc. measurement of drum & agitator speed etc.
- ❖ Checking of valve assembly and its blue matching with wear plate.
- ❖ Verification of dimensions for mud mixer, scroll, shaft assembly etc. and measurement of speed at no load.
- ❖ Working of lubrication system assembly.
- ❖ Water filling test in the trough.

2.3.9 Evaporators

- ❖ Verification of dimensions of calandria, body, catchall, tube plate thickness, holes etc., measurement of tube holes with go and no go gauge, alignment and distance between tube plates, ligament and pitch for tube holes, welding quality, witnessing hydraulic testing of steam and vapour valves etc.
- ❖ Checking the Layout of holes in the tube plate and its finish by Reaming, condensate outlet connections, noxious gases outlet connection, vapour inlet sizes, ovality of calandria, if any, tube plate straightness and tie rod fixing.
- ❖ Checking of save all construction & plate thickness & curvature of vanes etc.
- ❖ Inspection and testing of S.S./Brass tubes shall be as per **para 1.9**

2.3.10 Vacuum Pans (Batch & Continuous)

- ❖ As mentioned at **Para No.2.3.9**

2.3.11 Air and Water Cooled Crystallizers, Vacuum Crystallizers, Seed Crystallizers, Vertical Continuous Crystallizers

- ❖ Dimensional checking and capacity checking, quality of welding & plate thickness and reinforcement, stool centers etc.
- ❖ Witnessing hydraulic testing of cooling elements of water cooled and vertical crystallisers at 5 kg/cm^2.

- ❖ Witnessing of no load running trial of each horizontal crystallizer fitted with its stirrer at manufacturing site, checking of tooth contact of worm and worm wheel.
- ❖ Checking of clearance between stirrers and body.
- ❖ Checking of capacity calculations.
- ❖ Checking worm wheel and worm details.
- ❖ Checking of hardness of worm screw/shaft and scrutiny of material test certificate for En-8. steel.

2.4 Centrifugal Battery

2.4.1 Batch and continuous centrifugal machines.

- ❖ Inspection and testing of D.C. motors and panels as per procedure of **para 2.1.7**(b) at manufacturer works.
- ❖ Witnessing no load running trial of each centrifugal machine at manufacturer's site using test motor, checking of bearing temperature, vibration in terms of velocity and displacement at x,y,z axis, no load starting current, rpm measurement, pulley details,
- ❖ Hole details on basket – no. of holes, no. of rows and size of holes.
- ❖ Checking no. of cycles, working of panel, with respect to various steps for speed changing, steam and super heated water application etc.
- ❖ Checking of monitor casing, dimensions, etc..
- ❖ Checking dimensions of basket, shaft etc. with prescribed limits.
- ❖ Verification of material test certificate of basket and shaft, bearing housing.
- ❖ Basket welding checking by DP test and scrutiny of Radiography film/certificate.
- ❖ Verification of dynamic balancing certificate of basket assembly.
- ❖ Hydraulic testing of transient heaters.
- ❖ Inspection and testing of A.C. motors as per IS-4722 & IS-325 and control panels as per **para 2.1.7b (I)**.
- ❖ Witnessing hydraulic testing of superheated wash water system at 10 kg/cm sq.g.

2.4.2 Grass Hopper

- ❖ Dimensional verification
- ❖ Ultrasonic testing of Eccentric shaft and measurement of hardness and scrutiny of material test certificate for En 8 steel or special steel as the case may be, measurement of eccentricity.
- ❖ Witnessing no load running trial of each grass hopper.
- ❖ Checking of straight movement of hopper.
- ❖ Witnessing hydraulic test of air heater.
- ❖ Witnessing ultrasonic testing of drive shafts.

2.4.3 Sugar Grader

- ❖ Dimensional checking.
- ❖ No load running trial of each sugar grader assembly and measurement of Vibrations in terms of Amplitude, Frequency etc.
- ❖ Measurement of the slope of deck.
- ❖ Ultrasonic testing of drive shaft and measurement of hardness of shaft and scrutiny of material test certificate for En8 shaft or special steel shaft as the case may be.
- ❖ Measurement of screen hole – mesh sizes etc.

2.5 Condensing And Cooling System

2.5.1 Dimensional checking for condenser and ejector and material of construction with MTC.

2.5.2 Witnessing of hydraulic testing of condenser, ejector and tail pipe at 2 kg/cm^2 g, nozzle plate details, nozzle convergent angle and distance.

- ❖ Nozzle details of condenser/ejector.

2.5.3 Cooling Tower

- ❖ Verification of service factor for gear boxes.
- ❖ Verification of capacity of fans
- ❖ Dimensional checking of fans
- ❖ Witnessing of no load running trial of fans
- ❖ Measurement of vibration noise level capacity of fans.
- ❖ Scrutiny of material test certificate for gear box & blades.

2.5.4 Spray Pond

- ❖ Dimensional check for spray pond piping and nozzles as per approved drawing.
- ❖ Witnessing nozzle discharge testing at a head of 5 metres.
- ❖ Witnessing of hydraulic testing of assembled pipes of different size of spray pond piping, sample drawn at random,at 2.7kg/cm^2 g.
- ❖ MTC for nozzle and piping material.

2.6 Pressure Reducing Valves, Exhaust and Vapour Piping

2.6.1 PRDS Station

- ❖ Checking up of pressure reducing valves, bypass valves,
- ❖ Pneumatic control checking
- ❖ Desuper heater checking and water spray trial
- ❖ Hydraulic testing of valves and vessels.

2.6.2 Exhaust piping and vapour piping and valves more than 400 MM, NB size.

- ❖ Verification of dimensions, thickness, welding quality.
- ❖ Checking of valves for its components and witnessing hydraulic testing at 6 kg/cm^2.
- ❖ Verification of general arrangement drawing of exhaust/vapour piping.

2.7 Power Turbines and Electricals

2.7.1 Turbogear Unit with its Base frame

- ❖ Witnessing the no load running trial for each power turbine fitted with its gear box, governor and forced lubrication system and checking up of functioning of protective devices.
- ❖ Measurement of vibrations – Amplitude, Velocity, Frequency, Acceleration, Noise Level as per latest standards.
- ❖ Checking oil cooler for its material and witnessing of hydraulic testing.
- ❖ Verification of residual imbalance as per latest standards.
- ❖ Verification of test certificates for hydraulic testing of casings, rotor material test certificates, balancing certificate of rotor, blade surface crack and verification of Heat nos., Sl. No. of rotor, casing and turbine/test etc.

- ❖ Checking up of protective devices functioning while running at no load, rated speed such as Over Speed Trip, Low Lub-Oil Pressure, High Exhaust Pressure, Aux. Pump Cut Off/On etc.
- ❖ Checking blade construction and sizes as per data sheet.
- ❖ Open inspection of turbine and gear box – to examine condition of rotor, bearings, tooth contact of gears, back lash, hardness of gear, verification of service factor from catalogue and calculation with relevant standards, thrust clearance, clearance between moving and stationery blades, bearing clearance, trueness of rotor disc face.
- ❖ Verification of Characteristic Curve for Steam Consumption versus Load.
- ❖ Verification of Turbine Correction Factor Chart for variation of pressure, temperature for inlet steam and exhaust steam in relation to the Design Parameters.
- ❖ Open inspection of power turbine, rotor, gear box, bearings, checking up of tooth contact, back lash, bearings, etc.
- ❖ Verification of HP rating calculations for gear box.

2.7.2 Alternator for T.G. set

- ❖ Witnessing tests as described in latest IS 4722 such as insulation test and measurement of resistances of main field, main windings, exciter armature, and exciter field.
- ❖ Witnessing of open circuit test, short circuit test, overload test and H.V. test as per IS-4722.
- ❖ Verification of test certificates for ultrasonic testing and dynamic balancing of rotor.
- ❖ Phase sequence checking and verification of direction of rotation.
- ❖ Functional testing of AVR with alternator and regulation test, over voltage relay functional testing, on both AVR which are independent.
- ❖ Vibration measurement as per IS 12075 and sound level measurement during no load running trial of the alternator.
- ❖ Shaft current measurement.

2.7.3 Elecricals

a) Alternator Control & Excitation Panels for TG sets, MCC, Main distribution panel, Bus bar turnking, Bus coupler panel, APFC Panel, Control panel for DG set, Control panels for centrifugal machines.

- ❖ Verification of dimensions and makes of different components.
- ❖ Testing of simulation of various protective devices in each panel.
- ❖ H.V. and insulation test of each panel assembly, each MCC assembly and bus bar trunking assembly.
- ❖ No load sequence operation test of each panel assembly.

b) Verification of single line diagram of electrical distribution system as well as size of bus bars and cables and quantity of power factor improving capacitors.

NOTE: Type test as per IS 4722 shall also be witnessed in respect of any new size or design or manufacturer of alternator.

2.7.4 Power House Crane.

- ❖ As per detail mentioned for Cane Un-loader **para 2.1.1**.

2.8 H.P. Steam Piping

2.8.1 Distribution Header

- ❖ Witnessing of the Hydraulic Testing of Header.
- ❖ Dimensional checking
- ❖ Verification or material test certificate, IBR approval.

2.8.2 H.P. Piping

- ❖ Checking up Pressure Drop Calculations, Pipe Sizes with reference to Flow and Velocity and general arrangement drawing.
- ❖ Checking flexibility analysis, Scrutiny of material Test Certificate for the H.P. Piping.
- ❖ Checking and hydraulic testing of pipes and manipulation as per approved drawing.
- ❖ Checking of IBR stamping of pipings and flanges.

2.8.3 Steam Separators

- ❖ Material test certificate verification
- ❖ Dimension at check
- ❖ Witnessing of hydraulic testing

2.8.4 Valves covered by IBR (covering over and above 100 mm size, 20 kg/cm^2 pressure)

- ❖ Dimensional checking
- ❖ Witnessing hydraulic testing of sample drawn at random in each size.
- ❖ Scrutiny of test certificate given by manufacturer and C.I.B.
- ❖ IBR – stamping etc.

2.9 Miscellaneous

2.9.1 All C.I. Valves above 150 mm NB, all C.I. Pipes, Tees, Bend etc.

- ❖ Checking up of dimensions, internals and scrutiny of test certificate for S.S. components.
- ❖ Witnessing hydraulic testing of valves and pipes selected at random.

2.9.2 Bagasse Baling press

- ❖ Dimensional checking
- ❖ Witnessing of measurement of hardness for C.S. gear wheel, pinion as per specification.
- ❖ Witnessing no load running trial

3.0 APPROVED DRAWINGS : To be made available to Inspection Team.

3.1 The manufacturer shall make available all approved drawings, to the Inspection Team of Purchaser/ its Technical Consultant, at the time of inspection.

3.2 In addition to the above, the manufacturer shall obtain prior approval of NFCSF, New Delhi in respect of the following drawings and specifications :-

- ❖ Mill roller grooving and mill setting trash plate profile details.
- ❖ General arrangement drawing of the mill drive and transmission gearing system for the mills and pressure feeders along with HP rating calculations for enclosed gear boxes and open spur/helical gearing system with rpm details of gear and pinion geometry, material of construction, hardness and dimensions – checking.
- ❖ Heating surface calculations of boiler, including radiation zone, connvection zone, super heater, economiser, and air heater.

- Layout drawing of bagasse handling system.
- Calculations for capacity and head along with characteristic curves of ID fans, FD fans, and SA fans and wet/dry type fly ash arrestors.
- Heating surface calculations for Juice heaters, evaporators and vacuum pans and calculations for velocity of juice in J.H.
- General arrangement drawings of juice sulphiter, syrup sulphiter, juice heaters, each evaporator vessel, vacuum pans, air cooled, water cooled and vertical continuous crystalliser, condensers and ejectors, lay out of spray pond/cooling tower.
- General arrangement drawings of live steam piping including steam distribution header and PRDS with pressure drop calculations.
- General arrangement drawings with sizes of exhaust steam and vapour bleeding arrangement.
- Single line diagram of electrical distribution system showing feeder details.
- General arrangement drawing of main distribution board and MCC.
- General arrangement drawing of spray cooling piping along with sizing calculations.
- Specifications of all reductions gear boxes (giving input power and speed, ratio, size) and all pumps (giving speed, discharge, total head, HP of drive motor, fluid to be handled).Service factor calculation.
- Selection details of couplings, belts and bearings.

ANNEXURE XV

LIST OF ITEMS OF PLANT & MACHINERY REQUIRE PRE-DESPATCH INSPECTION AT MANUFACTURING WORKS

Inspection shall be made by the competent authority or Committee duly constituted by R.S.G.S.M.L. including concerning member of N.F.C.S.F. Delhi

I. Cane Milling Plant

1. Cane unloader including the bridge, trolley, grab, gear boxes, electric motors, control panel, driving and hoisting arrangements and supporting steel structure and gantry etc.

   Truck tippler with its hydraulic device etc.

2. Feeder tables including the chains, driving arrangements, assembly etc., including steel structure, variable speed drive and electric motor.

3. Cane carrier, auxiliary cane carrier and rake carrier including the structure, troughs, chains, rakes, slats, driving arrangement, driven shafts, idlers, spur gears, P. blocks including variable speed drive and electric motor etc.
   Belt type conveyer along with its drive, tramp iron separator etc.

4. Cane preparatory equipments including shafts, knives, bearings, plummer blocks, knife hubs, couplings, hammers, anvil plate, hood, deflector plate including electric motors etc.

5. Mills, pressure feeders including all head stocks, bed plates, roller and their shafts, trash beams, trash plates, under feed rollers, scrappers, mill couplings, tail bars, rake carriers, structure and trought, sprockets with shafts and chains, roller bearings, side caps and top caps of head stocks, crown pinions, pressure chute, Donnelly chute, juice troughts and whirler tanks etc. including fluid couplings and electric motors for rake carriers. Assembly of complete mill with rollers.
   Rotary type juice screening arrangement with drive etc.

6. Drives for Mills and pressure feeders with planetary gear boxes and oil coolers or, hydraulic drives with control panel or AC/DC motors with control panels and other accessories. Also drives for preparatory equipments.

7. Planetary gear boxes with rope couplings, oil pumps and oil coolers etc.

8. Bagasse conveyors including the structure, chains and slats, driving and driven shafts, driving system including Plummer blocks, and electric motors and gear boxes etc.

   Belt type prepared cane bagasse conveyor along with its drive, structure etc. but excluding electric and gear box.

9. Mill house crane including driving and hoisting arrangement, gear boxes and electric motors, bridge, trolley, crane hook, control panel and the gantry girders and structure.

II. Clarification, Evaporation And Boiling Plant

10. Juice and water check weigh bridges.

    Automatic juice weighing scale assembly and accessories and structure and counter etc.

11. Juice heaters including body, cover plates and tube plates, accessories like double beat valves, etc. arrangements for condensate extraction and noxious gas removal, vapour and exhaust steam valves etc.

12. Juice sulphiter assembly including the vessel and stirrer with driving arrangement, correction vessel, recovery tower, lime proportionater, automatic pH controller, driving arrangement, gear box electric motor, cast iron piping etc.

13. Sulphur furnace including burner, melter, scrubbers, cooling, inter-connecting cast iron pipes, valves, micro processor controller etc.

14. Air compressors including body, piston, crank shafts, connecting rod, drive, etc. in case of reciprocating type compressors and body, rotor (impeller), drive etc. in case of rotory type compressor including electric motor etc.

15. Lime slaker, lime classifier and hydro cyclone including driving arrangement, gear boxes and electric motors etc. but excluding milk of lime tanks.

16. Continuous clarifier including main body and tray plates, central shaft, scrapper, flash tank, juice overflow and mud overflow box with telescopic valves, cast iron valves, drive arrangement, worm and worm wheel including gear box and electric motor.

17. Vacuum filter assembly including the shell, S.S. decking, screen, scrapping arrangement, vacuum regulating system, juice withdrawal, S.S. piping assembly, juice trough with stirrer, juice separator in the vacuum line, driving arrangement, electric motors, gear boxes etc.

    Belt conveyor with drive etc. for the filter cake.

18. Evaporator including bodies and calandria with tube plates, steam/ vapour and juice distribution, condensate extraction and noxious gas removal systems, inter-connecting vapour pipes, save all, vapour and exhaust steam valves etc.

19. Syrup sulphitation unit including the body, SO_2 gas distribution, coil assembly, absorption tower, cast iron piping etc.

20. Vacuum pans, including the body and calandria/with tube plates, save all, steam/vapour distribution, condensate extraction and noxious gas removal systems, discharge valves, vapour and exhaust valves etc.

21. Seed, vacuum, air cooled and water cooled horizontal crystallisers & vertical crystallisers assembly including the main shell, stirring arrangement, cooling/heating coils, driving arrangement, worm wheel and worm box and enclosed gear box and electric motor etc.

22. All condensers & ejectors duly assembled including the main body with the nozzles and their header, throat and tail pipes etc.

23. Spray pond cooling system including all piping, nozzles, junction boxes, headers, bends, tees, suction strainer etc.

    In case of cooling towers, the fans with driving arrangement, grid bars, nozzles, headers and piping etc.

24. Tubes for juice heaters, evaporators and vacuum pans.

III. Cooling, Curing and Grading Plant

25. All batch and continuous centrifugal machines assembly including basket, shaft, bearings, and their housing, monitor casing, drive motor with its panel, solenoid valves, control panels, pneumatic valves, ploughing arrangement.

26. Superheated wash water arrangement and transient heaters for centrifugal machines.

27. Sugar grass hopper assembly including trays, driving arrangements, hot and cold air blowing arrangement, air heater, blower, electric motor etc.

28. Sugar drier including trays, driving arrangement, electric motor, ID fan with drive, FD fan with drive etc.

29. Sugar grader assembly including the main body, screens, driving arrangement, supporting steel structure, chutes, electric motor and magnetic seperators etc.

30. Molasses weighing scale assembly including the structure, tanks, registering counter etc.

31. Pug mills, magma mixers and sugar melter, all run-off molasses tank &Sugar elevator.

IV. Steam Generating Plant

32. Boilers including drums, headers, super heater and economiser coils, main bank and furnace tubes, soot blowers, ID, FD and secondary air fans with driving arrangement, turbine for turbo feed pump, furnace grate assembly, grate bars, wet/dry type fly ash arrestor, de-aerator, electric motors (A.C.), ducting, piping etc.

    If the boiler fans driven by D.C/A.C. variable frequency shall be inspected at manufacturer's works before dispatch.
    Feed water tank and de-aerated water tank.

V. Power Generating Plant

33. Turbo alternator set including turbines, alternator, enclosed reduction gear box assembly on base frame, protective devices of the turbine and alternator, excitation and control panel, oil coolers, radiator, bus bar trunking, governing system.

34. Power house crane including bridge, trolley and gantry girders etc.

35. Steam pressure reducing valves including main valves, by-pass arrangement, controls system, desuperheater, etc.

VI. Miscellaneous Items

36. Common desuperheater for exhaust steam.
37. All exhaust steam and vapour piping including valves of size 400 mm NB and above for juice heaters, evaporators pans and pan discharge valves
38. All cast iron valves of 150 mm NB and above.
39. All IBR valves of 100 mm NB and above
40. All CI pipes, tees, crosses, and bends.
41. Bagasse baling press with driving arrangement etc.
42. All main distribution panels, motor control, centers, auxiliary panel, lighting distribution boards, etc.
43. Steam distribution header and steam separators for live steam piping.
44. All D.C. electric motors including control panels.
45. All variable frequency drive control panels.
46. All electric motors (AC & DC) along with control panels for driving continuous and batch centrifugal machines.
47. All AC motors above 50 H.P. rating.
48. Spray and injection pumps, vacuum pumps to be inspected at manufacturer's work.

ANEXURE XVI

LIST OF ITEMS OF PLANT & MACHINERY WHICH DO NOT REQUIRE PRE DISPATCH INSPECTION

I. Cane Milling Plant

1. Fluid couplings and and all other type of couplings.
2. Hydro pneumatic accumulators, pumping set, gauge panel, piping etc. for hydraulic loading system of mills.
3. A.C. electric motors and enclosed worm/helical gear boxes for cane/rake carriers, cane preparatory devices, baggasse conveyors having rating below 50 HP etc.
4. Automatic cane feeding device.
5. Oil and grease lubricators.
6. Mill house imbibition equipment juice pumps and water pumps.
7. Mill service gangway /platform and all steel structure.

II. Clarification, Evaporation And Boiling Plant

8. All type of pumps for juice, syrup, massecuite, mud, milk of lime, magma, melt, molasses, condensate etc.
9. Equipment for preparation, storage and pumping of phosphate slurry and caustic soda solution.
10. All priming pumps.
11. Molasses conditioners and milk of lime tanks.
12. All condensate receivers and tanks, juice/syrup/lime strainers/grit catcher, all receiving tanks for weighed juice/water/molasses/syrup etc.
13. All pin and bush couplings in the boiling house.
14. Syrup and molasses storage tanks, mud receiving tank, sulphited juice/syrup receiving tank etc.
15. All supporting steel structure for boiling house and clarification house.
16. All worm type enclosed gear boxes and A.C. electric motors below 50 HP rating except those for vacuum filter, juice sulphiter, lime slaker an lime classifier.

III. Cooling, Curing And Grading Plant

17. Supporting steel structure for batch and continuous centrifugal machines. Monorail with chain pulley block for centrifugal battery.
18. Pumps for magma, melt, molasses, hot & cold water etc.
19. All pin and bush couplings for centrifugal station auxiliary equipment.
20. All worm type enclosed gear boxes.

21. Sugar weighing machines and bag stitching machines.

22. Final molasses storage tanks.

23. Overhead hot and cold water service tanks.

IV. Steam Generating Plant

24. All supporting steel structure for boilers.

25. Rotary bagasse feeders and rotary air lock valve including their drives etc.

26. Feed water transfer pumps along with electric motors, starters etc. but excluding steam turbine.

27. Chemical dosing equipment and its pumps etc.

28. Boiler ducting, ash hoppers etc.

29. All refractory and insulating materials.

30. Blow down tank and its piping etc.

31. Air preheater and its tubes.

32. Instrument panel with accessories and fittings, all instruments and gauges etc.

33. Boiler chimney.

34. Boiler feed water treatment plant / R.O. Plant.

V. Miscellaneous Items

35. All electric power and control cables.
36. All earthing material and lighting fixtures.
37 All pressure, vacuum and temperature gauges/recorders, steam/water flowmeters and recorders.
38. All non-IBR M.S./Stainless steel piping, bends, flange etc. below 400 mm NB.
39. All IBR valves below 100 mm NB including drain valves, steam traps, strainers, blow down valves, safety valves, isolating valves etc.
40. All IBR steam piping, bends, flanges etc. excluding steam distribution header and separators.
41. All lagging and insulating materials.
42. All A.C. electric motors below 50 HP.
43. All worm type enclosed gear boxes.
44. All pumps except vacuum pumps spray and injection pumps.
45. All cast iron valves below 125 mm NB.

Purchaser has right to ask for Pre-Inspection of any of the equipment on receipt of dispatch intimation from supplier.

ANNEXURE XVII

UPDATED GUIDELINES FOR TESTS AND TRIALS BEFORE START OF CRUSHING SEASON OF SUGAR PLANT

In order to ensure smooth and efficient cane crushing operations, it is absolutely necessary that the tests and trials of the different equipments and pipelines are taken before the crushing season is started. As far as possible, the trials of the moving machinery should be taken on load.

The hydraulic tests of all the pipelines, heat transfer vessels including boiler pressure parts, juice heaters, evaporator vessels, pans, condensers, etc should be taken at the prescribed pressures, after completion of erection and fitting of various valves, mountings etc. However, fitting of safety valves and insulation / lagging should be done after hydraulic testing. The running trials should be taken in phases.

The recommended procedure for hydraulic testing and running trials is follows:-

1 Hydraulic Test Of the Pipelines, Vessels, Tanks, Etc.

The following pressures are recommended for hydraulic testing the different pipes, vessels, etc. after completion of erection, but before lagging / insulation.

i Boiler pressure parts including super heaters – 1½ times the working pressure.

ii Live steam piping, PRD station, desuper heater vessels, exhaust steam piping with valves etc. – 1½ times the working pressure.

iii All process & water piping including spray / injection water, condensate, juice, water, syrup, molasses, magma, etc. should be tested for leakages by pumping water after taking into line the required pumps and equipments.
The compressed air receivers, superheated wash water vessel, radiator for alternator, steam jacket of sulphur burners, air heaters for grass hoppers, turbine oil coolers, mill roller bearing etc. – 1½ times the working pressure.

v Calandria of tubular juice heaters – 10 kg/sq. cm.

vi Calandria of evaporators and pans – 5 kg/sq. cm

vii All the juice trays, juice receiving tanks, boiler feed water & deaerated water tanks, clarifier, evaporator bodies, pan bodies, condensers with tail pipes, vapour pipes at the evaproator and pan stations, syrup and molasses storage tanks and other tanks etc. should be tested for leakages by completely filling with eater.
The bodies of tubular juice heaters should be tested by pumping water using the mixed / sulphited juice pumps.

2 Running Trials of Individual Equipment

After the hydraulic tests have been completed satisfactorily, the running trials of the plant and machinery should be taken in phases. In the first phase, individual no load running trials of all the moving machinery should be taken. Before the machine is meggar and direction of rotation of the motors and the prime movers should be examined after taking out coupling bolts. After removing the initial effects during the individual trials, the endurance trial of each moving equipment should be continuously taken at no load in the second phase for the period noted below:-

i Cane truck tippler/ unloader etc. – 4 hours.

ii Feeder table – 8 hours
iii Cane carrier – 12 hours.

iv Cane kicker / chopper – 12 hours

v Cane leveller / cutter/fibrizer/shredder assembly – 12 hours. During running trials, vibration levels should be measured and recorded.

vi Mills including pressure feeder, rake carriers etc. – 24 hrs.

During this period, grinding of the trash plates, scrappers, etc. shold be completed. The vibration levels at mill drive motor/turbine and gear boxes hould be measured and recorded. All the safety devices for the turbines/motors should be tested for satisfactory operation.

vii Imbibition equipment including rotary screen, screw conveyor and mixed juice pumps – 8 hours.

viii Bagasse elevator and conveyor including cross carriers & RBC – 24 hours.

ix Juice and water weighing scale – 8 hours.

x Juice sulphiters – 8 hours

xi Air compressor – 4 hours

xii Lime slacker, MOL pump, lime storage tank – 4 hours.

xiii Vacuum filter including feed mixed – 8 hours.

xiv Juice heaters, evaporators and pans – each 8 hours.

During the endurance trials of these equipments, water should be heated and boiled and vacuum trials should also be conducted.

xv All juice, syrup, water, condensate, molasses, magma, injection, spray pumps, etc.- each 8 hours.
xvi Seed, vacuum, water cooled, air cooled and continuous verical crystallizers – 24 hours.

xvii Each centrifugal machine – 2 to 4 hours.

It should be ensured that all the solenoid and pneumatic valves, electrical panels & fittings, lubricating system, etc. work satisfactorily. During running trials, the vibration levels should be measured and recorded.

xviii Sugar melter, pug mills & magma mixers – 4 hours.

xix Grass hoppers including hot/cold air blowers – 16 hours

xx Sugar elevator – 16 hours

xxi Sugar grader – 16 hours

xxii Molasses weighing scale – 4 hours

xxiii Boilers – The boilers should be slow fired about 7/10 days before raising steam. This is required to dry the new refractory bricks properly. Thereafter, chemical boiling is to be carried out as per boiler supplier's recommendations.

Steam should be raised to working pressure in all the boilers and necessary adjustment of safety valves, etc. should be made as per boiler supplier's recommendations.

After the above trials are completed, the steam pipelines upto the prime movers are to be blow off.

All mountings, fittings, control system and safety devices for the boilers should be tested for satisfactory operation.

xxiv The auxiliary oil burning equipment should be tested for 4 hours.

xxv ID, FD and secondary air fans – each 8 hours.

During running trials, the vibration levels of the fans should be measured and recorded.

xxvi Boiler instrument and control system should be tested for proper operation of various systems.

xxvii Turbo alternator set – The turbo alternator should have tiral runs on part load at least for two days. During each day, the set should be worked for 6 hrs. For putting load on the alternator, electric motor driven pumps and other electrical equipments should be simultaneously run and tested. During the running trials of the turbo alternator set, vibration level should be measured and recorded. All the safety devices of the turbo alternator set should be checked and tested for satisfactory operation.
In case major defects are detected, the endurance trials should be repeated. The endurance trials should be conducted till all the major defects have been removed.

3 Composite Steam and Water Trials of the Plant

After the endurance trials of all the moving machines and equipments has been carried out individually and the defects rectified, composite steam and water trial should be conducted. In these final trials, all the items of plant and machinery should be run simultaneously using water instead of juice and the entire electrical load should be put on the turbo alternator. The pumping sets should never be run dry. The water should be pumped from the mill house to the pans in proper sequence. It should be heated in the juice heaters and boiling should be done in the evaporators and pans. Initial filling of boilers should be done by treated water conforming to boiler supplier's recommendations. Water softening/demineralised plant should be commissioned sufficiently in advance so that boiler feed water storage tank contains sufficient treated water for initial feed as well as make up water required during initial periods of steam trials.

No exhaust should be blown out. The boiling in the multiple effect evaporator should be started immediately after the prime movers have been commissioned. Immediately after the condensate is available, it should be fed in the boilers and treated raw water should be used only as make up water. The surplus condensate should be collected in a tank to be used as and when required. It should be ensured that except the initial filling in the boilers, no treated raw water is taken as far as possible.

During this process of boiling, if there is any apprehension of formation of scales in the evaporator set, the raw water to be used in the evaporator should be treated by heating the same in the juice heaters and treating by lime and washing soda in the juice sulphiter. Halogens (chlorides /fluorides) should not be used if the juice heaters, evaporator or pans are fitted with stainless steel tubes.

The treated and boiler water should be sent to the continuous clarifier and decanted water from the clarifier should be taken in the evaporator. This process should be continuous during the period the boiling in the evaporator is continued. This will also enable thorough testing of the juice heaters, slphiters, continuous clarifier and evaporators without such scaling. Similarly, the boiling in the pan should be done with soft treated water available from the clarifier.

The composite steam and water tiral may be done once for a period of 8/10 hours and it should be ensured that all defects are rectified. If major defects are noticed during the composite trials, the same should be repeated after rectifying the defects noted during the first composite trials.

4 Recording of Data Pertaining to Tests & Trials

The recording of data is as important as tests and trials themselves. It is suggested that sectionwise registers may be maintained by the concerned Enginee/Chemist. All the details such as broad specifications of the equipment, date of hydraulic testing/running trial, name of the persons) supervising the trials and the result of the trials such as load on the drive motor/turbine, vibration level, bearing temperature, steam pressure and temperature, voltage and frequency, any other observations with regard to smooth working or otherwise, should be recorded. This will facilitate proper diagnosis and monitoring of the tests and trials.

ANNEXURE XVIII

SCHEDULE OF SUBMISSION OF DRAWINGS, MANUALS & OTHER DOCUMENTS

A (1) SUBMISSION OF DRAWINGS

1.1 Finalisation of tentative layout (within 20 days from the date of signing of the agreement) showing the provision for future equipment required of ultimate capacity, in consultation with NFCSF.

1.2 Within 30 days from the date of signing of the agreement, 2 copies of the general layout of the factory building showing the positions of the auxiliary cane carrier, **40 ton** boiler, spray pond and connecting channels, cogen. power house etc. for the approval of the Purchaser/National Federation. In the general layout, the Sellers shall also show the span, center to center distance of column, height of the trusses of the main factory building, span of the mills and power house cranes together with their maximum wheel load etc. The Purchaser/National Federation shall unless they have any objection approve the same in writing or indicate the corrections (required to be incorporated by sellers) subject to which the drawings can be deemed as approved so that the purchaser can go ahead further to save time. The sellers shall however incorporate the required correction and submit 6 copies of general layout for final approval and records.

1.3 Within 15 days from the date of receipt of approval of general layout of the factory building as in 1.1 above, 2 copies of the engineering layout of the plant and machinery for the approval of the Purchaser/National Federation. The Purchaser/National Federation shall unless they have any objection, approve this layout in writing and dispatch it with their approval/comments (by which the drawings can be deemed as approved – for saving time for execution) to the sellers within 10 days of its receipt. Sellers shall incorporate the required correction (if any) and submit 6 copies of engineering layout for final approval and records.

1.4 Within 10 days from the date of approval of engineering layout as above, 2 copies of the detailed juice flow diagram of the sugar plant for approval by the Purchaser/National Federation. The Purchaser/National Federation shall unless they have objection approve the same in writing and dispatch their approval/comments to the Sellers within 15 days of its receipt. If correction are sought by Purchaser/National Federation the Sellers shall incorporate the same and submit 6 copies of detailed juice flow diagram for the final approval and implementation.

1.5 Within one week of finalization of engineering layout the Sellers shall, in consultation with Purchaser, National Federation, Architect and Civil Contractor of Purchaser, indicate the dates in the proforma given below so as to commission the plant and machinery by the stipulated date i.e. ……

S.No.	Description	Drawing & details to be received from the Sellers	Completion of designing of foundations by the Architect & submission to Sellers for comments and approval	Completion date of foundation by civil contractor for starting the erection work	Date of start and completion of supvervision of erection by the Sellers
1	2	3	4	5	6

i. DG set- No. 1
ii. Boiler/s pressure parts
iii. Boiler auxiliaries
iv. DM plant and DM water storage tank
v. RCC chimney (Duct opening only)
vi. Bagasse handling carriers etc.

vii. Boiler house shed .
- a) Foundations for columns
- b) Erection of trusses, alignment & grouting
- c) Roofing
- d) Side cladding
- e) Walling if any
- f) Stair cases

viii. Auxilary Cane carrier & unloading equipment
ix. Cane preparatory devices
x. Mill house cane gantry
xi. Milling plant & drive
xii. Mills plant shed .
- a) Foundations for columns
- b) Erection of trusses, alignment & grouting
- c) Roofing
- d) Side cladding
- e) Walling if any
- f) Stair cases

xiii. Boiler Chimney .
xiv. Bagasse Elevator, Bagasse Carrier & RBC, belt conveyor
xv. Turbo-alternator set/s
xvi. Earthing and lighting yard
xviii) Power house shed .
- a) Foundations for columns
- b) Erection of trusses, alignment & grouting

29.0 Roofing
30.0 Side cladding
31.0 Walling if any
32.0 Stair cases
xix) Clarifier
xx) Clarification plant shed .
- a) Foundations for columns
- b) Erection of trusses, alignment & grouting
- c) Roofing
- d) Side cladding
- e) Walling if any
- f) Stair cases

xxi) Boiling House staging (internal)
xxii) Boiling house shed .
- a) Foundations for columns
- b) Erection of trusses, alignment & grouting
- c) Roofing
- d) Side cladding
- e) Walling if any
- f) Stair cases

xxiii) Centrifugal machines
xxiv) Drier House Equipment
xxv) Bagging house shed .
- a) Foundations for columns
- b) Erection of trusses, alignment & grouting
- c) Roofing

d) Side cladding
e) Walling if any
f) Stair cases

xxvi) Electricals including trenches

xxvii) Juice & water check weighment and Molasses weighing scales

xxviii) Pumps & other miscellaneous Foundations

xxix) Spray pond
a) Column & spray pump Foundations and roof
b) Remaining work

xxx) Hot & cold water channels
a) Injection pump beds
b) Corresponding channels
c) Remaining work

xxxi) Final Molasses Tanks

1.6 Progressively and in proper sequence, within 3 months of the date of signing this Agreement, 2 copies of the following shall be submitted to National Federation for their approval. National Federation shall return the drawings within 2 weeks with due comments/approval. Sellers shall incorporate the correction, if suggested by National Federation, and submit 6 sets of drawings for final approval and implementation

a) Layout of the pipelines, including live and exhaust steam lines, vapour pipelines, juice, syrup and missecuite pipelines, cold and hot water lines and single line diagram for electric power installation showing all the details etc.

b) Drawings of the staging for the plant and machinery along with a stability certificate from a Chartered Structural Engineer.

c) Drawings showing all dimensions of juice heaters, evaporators, juice and syrup sulphiters, hoppers, cane bagasse carriers etc.

d) Detailed calculations in duplicate regarding the heating surfaces of i) boilers ii) evaporators iii) pans and iv) juice-heaters. In case there is any comments by the Purchasers the matter shall be taken up by them with the appropriate authorities including the Boiler Inspectorate.

e) The Purchasers shall furnish to the Sellers within 1 month of the signing of this Agreement, 2 copies of plan showing the locations of main factory building, molasses storage tanks.

1.7 Progressively within 4 months from the date of signing of the Agreement, 6 copies of all general arrangement drawings and instruction manuals as may be required for running and maintenance of the plant and machinery, pipelines, electrical installation etc. except that in case of imported machines all drawings and instruction manuals in respect thereof, shall wherever necessary for running and maintenance of the plant and machinery be submitted at the time of delivery.

1.8 In all cases where provision exists for approval by Purchasers of the drawings, diagrams of layouts, one copy of the said drawings, diagrams or layout shall be returned to the Sellers with the comments/approval in writing thereon by the Purchasers within the time provided therefore. While drawings are required to be resubmitted for approval, 6 copies of the revised drawings shall be submitted to the purchaser/National Federation by the sellers within 3 weeks of the receipt of the latter's' comments.

1.9 Purchaser/National Federation shall have the right to suggest minor modifications to be made in the drawings, diagrams or layout as in their opinion may appear necessary for

more efficient functioning of the plant and machinery and as may be mutually agreed upon by the Sellers and Purchasers.

1.10 The drawings to be furnished by sellers for constructing the civil foundation should indicate the load data considered viz. additional load of future equipment wherever mentioned in Annexures-I & II.

2. MISTAKES IN DRAWINGS

The Sellers shall be responsible for and shall pay for any alternations of the plant and machinery due to any discrepancies of errors or omissions in the drawings or other particulars supplied by them whether such drawings or particulars have been approved by the Purchasers or not.

B. MANUALS AND OTHER DOCUMENTS

The sellers shall submit the following information, progressively within 4 months of signing the agreement. (this information shall also be filled in the proforma mentioned under 1.5 above)

i) 6 (six) sets of civil scope design data and necessary information in respect of all civil and structural engineering work including cable trenches, drains etc., to be carried out by the Purchaser. Design data should contain enough information on static load and other design data required for detailed calculations and designs for all plant buildings, structures, misc. works etc.

ii) 6 (six) sets of plans for equipment layout drawings showing all the details of the relevant location and space requirement of each item of plant and equipment.

iii) 6 (six) copies of flow sheets, showing the details of the flows pertaining to raw-materials, utilities and other inputs, items of machinery and equipments etc.

iv) 6 (six) copies of the plant operation and maintenance manuals containing specifications and detailed working guidance for each item of equipment, maintenance procedures, specifications of lubricants (of at least 4 prominent National lubricant oil manufacturers) recommended for all machinery and equipment to enable the Purchaser to arrange for the procurement of the same.

v) 6 (six) copies of the manuals of instructions for care and safe custody of plant and equipment at site and for their erection prior to the despatch of the plant and equipment.

vi) Such other information, explanation and advises as may be requested from time to time by the Purchasers/NFCSF with regard to the installation, erection start-up and operation of the plant for and upto a period of 2 (two) years after commissioning.

vii) 3 months before commissioning of the plant & machinery the seller shall furnish to the Purchasers the following:

a) 3 sets of list of all Ball/Roller bearings fitted in the Sugar Plant indicating bearing numbers, make and place of use etc.

b) 3 sets of list of all electric motors installed in the sugar plant (equipment wise stating motor type, HP & rpm etc.)

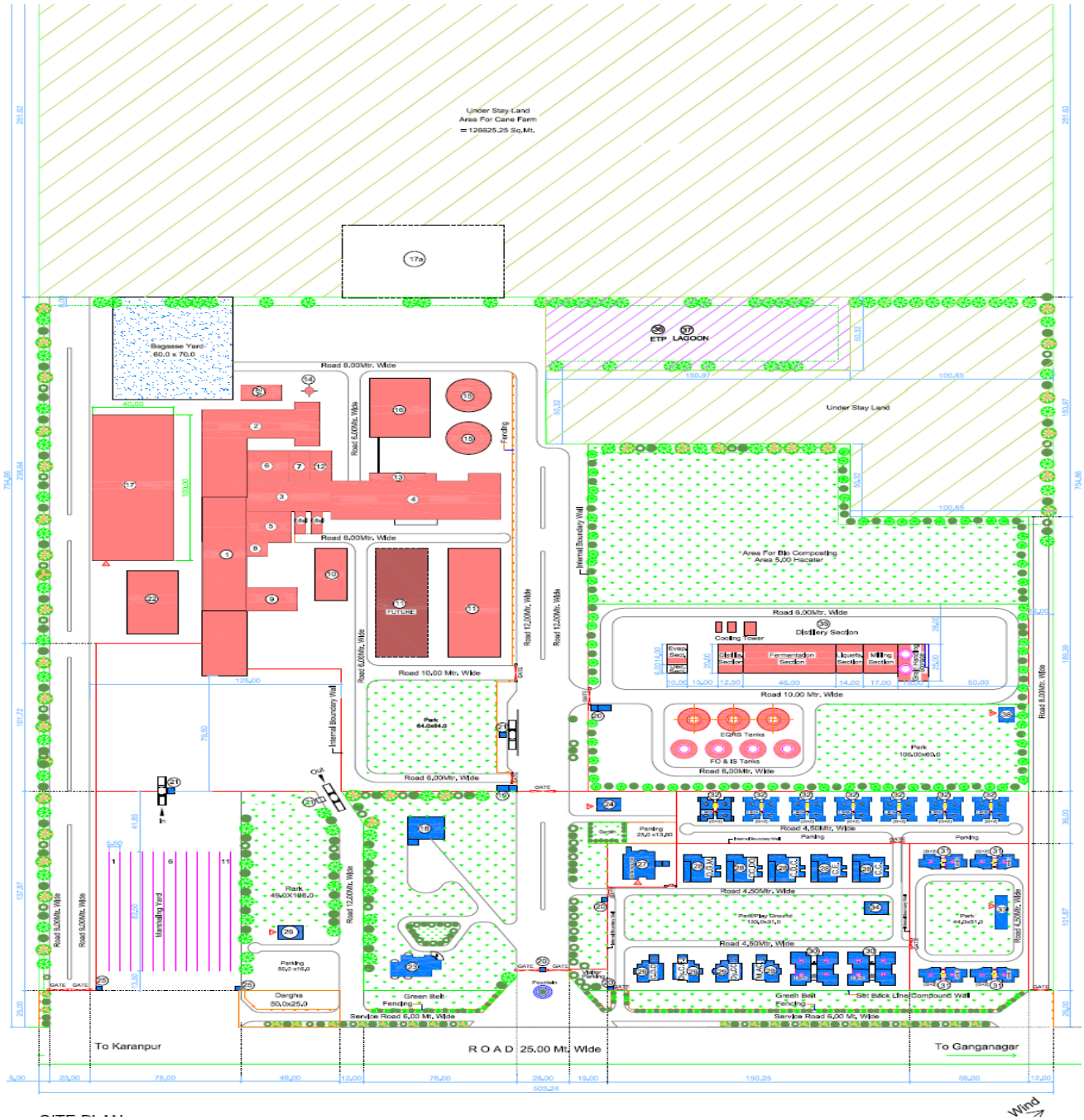
c) 3 sets of list of all reduction gear boxes installed in the plant indicating the place of use, gear box type, ratio, hp rating and service factor etc.

d) 3 sets of list of all pumps installed in the plant indicating the type of pump, duty, discharge & total head etc.

e) 3 sets of list of all coupling bushes, oil seals etc. fitted in the plant indicating the place of use, type & sizes etc.

ANNEXURE XIX

TENTATIVE LAYOUT PLAN



PERT /BAR CHART START FROM DATE OF AGREEMENT FOR FOUNDATION, SUPPLY, ERECTION & COMMISSIONING OF SUGAR PROJECT

S. No.	Task Name	Start from agreement date	Finish	1 Month 1	2 Month 2	3 Month 3	4 Month 4	5 Month 5	6 Month 6	7 Month 7	8 Month 8	9 Month 9	10 Month 10	11 Month 11	12 Month 12	13 Month 13	14 Month 14
1.	Sugar & Co-gen Project	1St Month	396 Days														
2.	Milling Tandem	1St Month	396 Days														
3.	Foundation	1St Month	167 Days														
4.	Supply	2Nd Month	183 Days														
5.	Erection	3Rd Month	279 Days														
6.	Commissioning	12 Th Month	47 Days														
7.	Boiler	1St Month	396 Days														
8.	Foundation	1St Month	120 Days														
9.	Supply	3Rd Month	218 Days														
10.	Erection	4Th Month	269 Days														
11.	Commissioning	12 Th Month	62 Days														
12.	Boiling House & ETP	1St Month	396 Days														
13.	Foundation	1St Month	180 Days														
14.	Supply	3Rd Month	284 Days														
15.	Erection	6 Th Month	220 Days														
16.	Commissioning	13 Th Month	31 Days														
17.	Power House	2Nd Month	371 Days														
18.	Foundation	2Nd Month	120 Days														
19.	Supply	5Th Month	169 Days														
20.	Erection	7 Th Month	170 Days														
21.	Commissioning	13 Th Month	31 Days														

Annexure XXI

M :RSGSM FAX NO. :01542480122 Mar. 13 2013 01:14PM P1

ANEXURE'A' (OF ADDENDA) 276

(122)

OFFICE OF THE JUNIOR CHEMIST

PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY SRIGANGANAGAR

REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2011-2012/ 328 Dated : 22.6.11

To,

District: Sri Ganganagar
Tehsil: Karanpur

महा प्रबन्धक,
राज. स्टेट, गंगानगर शुगर मिल्स लि.,
श्री गंगानगर

Reference :Your Letter No.- 3054 Dated: 21.6.11 Name of Sample Taker: Sh. Sanjay Malhotra (Chemist) Yourself

Date of Receipt : 21.6.11

Source	गंगा का पानी (Canal)				
Source Location	चक 23-F (करणीपुरा)				
Village/Town/ City	23-F				
Habitation	–				
Village Code No.	–				
Date of Collection	21.6.11				
Date of Examination	22.6.11				
Lab. Sample No.	R-13				

Note :- All results Except pH are in mg/L

1	pH	7.11					
2	Turbidity (NTU)	52					
3	Temperature (°C)	–					
4	Colour (Hazen Units)	unobj.					
5	Odour	unobj.					
6	Total Alkalinity (as $CaCO_3$)	90					
7	Total Hardness (as $CaCO_3$)	110					
8	Calcium (as Ca)	16					
9	Magnesium (as Mg)	16					
12	Chloride (as Cl^-)	20					
13	Sulphate (as SO_4^{-2})	30					
14	Nitrite (as NO_2^-)	–					
15	Nitrates (as NO_3^-)	03					
16	Fluoride (as F^-)	0.2					
17	Total Dissolved Solids	190					
18	Residual Chlorine	–					

Note :- (1) Samples are not collected by laboratory. (2) Report is not valid for water quality legal purposes.

Note : (1) Samples are not collected by laboratory.
(2) Report is not valid for water quality legal purposes.

22.6.11

Junior Chemist
PHED Lab Sriganganagar
कनिष्ठ रसायनज्ञ
जन स्वा. अभि. विभाग
जिला प्रयोगशाला,
श्रीगंगानगर

No. Lab/Tech(Chem)/2011-2012/ Dated:

Copy to:-

1 The Chief Chemist, Public Health Engineering Department, Rajesthan, Jaipur.
2 The Senior Chemist, Public Health Engineering Department Lab. Bikaner.

Junior Chemist
PHED Lab Sriganganagar