Doc. No.: GP&EC/PNQ/BID-EPC-DIST/20-21/NT/052
Date : January 06, 2021
Assign. No.: PWR-2019-02335
Date : August 31, 2019

TECHNICAL BID DOCUMENT
(VOLUME II OF II)

FOR

EPC OF 30 KLPD MOLASSES BASED DISTILLERY PLANT WITH RAW SPENT WASH EVAPORATION, & BALANCE OF PLANT

AT

SHRI VRIDHESHWAR SAHAKARI SAKHAR KARKHANA LIMITED (SVSSKL)

AT/POST ADINATHNAGAR, TALUKA PATHARDI, DISTRICT AHMEDNAGAR - 414 505 MAHARASHTRA

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LIST OF APPENDICES

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PROJECT INTRODUCTION

PROJECT AT A GLANCE

Shri Vridheshwar Sahakari Sakhar Karkhana Ltd (SVSSKL) is a public limited Company, engaged in manufacturing of sugar. SVSSKL is situated at Adinath Nagar, Taluka - Pathardi, District – Ahmednagar, Maharashtra with sugar plant and power plant.

SVSSKL, proposes to set up a 30 KLPD capacity distillery to produce ethanol, adjacent to the existing sugar plant

The proposed project will produce fuel ethanol from own molasses and optimum quantity of diverted B-heavy molasses, as well as procured molasses from nearby sugar factories as raw material. The steam and power requirement for the proposed plant will be made available from the new slop fired incineration boiler & condensing turbine.

This EPC bid covers engineering, supply to commissioning of the Distillery /Ethanol plant along with all required and specified balance of plant, excluding civil works

The proposed distillery / ethanol plant of 30 KLPD capacity will employ fermentation, multi pressure distillation system, MSDH section, Evaporation, CPU unit etc. Sugar factory will supply cane juice / B-molasses / C-molasses.

All steam and power requirements of the distillery, co-gen auxiliaries during operating periods, will be met internally from the incineration co-gen power plant.

The ethanol plant will have standalone incineration boiler and suitable turbine & hence, will be self-sufficient in steam and power requirement and will operate for about 300 days consistently. The ethanol plant will employ latest technology and equipment in the fermentation and distillation, as well as use raw materials as in house Cane Juice/C-Molasses/B heavy molasses from own sugar plant operation.

SVSSKL also proposes to install Zero Liquid Discharge (ZLD) system to treat the spent wash, integrated & standalone evaporation plant, followed by incineration boiler & waste water treatment plant, to enable recycle of major process condensate, which will reduce fresh water intake.

SECTION - 1

SCOPE OF SUPPLY

1.1 SCOPE OF SUPPLY

1.1.1 Certain expressions used in the Specification relate to various stages of the Contract. The overall scope of work included in each stage is briefly outlined below for guidance, but not so as to relieve the Bidder of his obligation to do anything that may not be so described or is reasonably to be inferred as necessary to complete his performance of the Contract in accordance with all its terms.

1.1.2 The Bidder shall design, manufacture, supply, construct, and commission the specified DISTILLERY PLANT required by the Purchaser for the initial development of the Shri Vridheshwar Sahakari Sakhar Karkhana Limited, Pathardi. (SVSSKL). The scope of the works will cover the execution of all structures, buildings, mechanical equipment, electrical, instrument & automation, erection, testing, commissioning and maintenance as detailed in the specifications and drawings.

1.1.3 "Design" includes developing the Item Specifications and Drawings contained in the Contract, in order that full information shall be provided in good time by the Bidder to the Purchaser and Consultant concerning the equipment and facilities to be supplied and all other work to be carried out under the Contract.

1.1.4 "Supply" includes manufacturing or procuring the specified items and spare parts, carrying out all tests and facilitating all inspections prior to packing and transporting the same, delivering the same to Site.

The design, manufacture (including procurement, quality assurance, manufacture/ Construction, installation, Pre-commissioning and delivery), assembly at site of Distillery/Ethanol Plant comprising of:

a. Cane Juice / syrup cooling unit
b. Molasses Storage & handling
c. Fermentation Plant
d. Distillation Plant
e. Ethanol Plant

f. Finished Product Day Receivers and Bulk Storage
g. Raw Spent Wash Integrated followed by Stand by Evaporation Plant
h. Mechanical Balance of Plant
i. Automation and Instrumentation
j. Piping, insulation and cladding
k. Staging, Structure, Platform and Staircases
l. Electrical equipment & complete Electrical

The supply also includes transportation (including, without limitation, unloading and hauling to, from and at the site), delivery to site and storage; as well as the material handling, transportation from project storage yard to erection site, checking, chipping and leveling of foundations, pre-assembling etc.

1.1.5 "Construct" includes constructing/ assembling/ erecting/ installing as appropriate all (excluding civil) mechanical, electrical, process and instrumentation works and items included in this document to form a complete and operational Distillery Plant.

1.1.6 "Complete" includes carrying out all Tests on Completion in order that the Purchaser may take over the Works in accordance with the Contract.

1.1.7 "Commission" includes the Tests on Completion, witnessing the Performance Tests and carrying out such ongoing advisory and training activities as may be required under the Contract or otherwise agreed from time to time with the Purchaser.

1.1.8 "Maintain" includes carrying out all corrective and remedial work required for the Works during the Period of Maintenance set out in the Contract, but excludes work arising from fair wear and tear due to use of the Works by the Purchaser.

1.1.9 The Plant shall be supplied complete, including all accessories and materials required to ensure the efficient operation of the Works at the specified performance levels.

Any equipment, device or material even if not included in the original bid, but found necessary for the safe and satisfactory functioning of the units under the bid shall be supplied, erected and commissioned by the Bidder without any extra cost to the Purchaser, as if such equipment, material or work were originally specified and formed part of the scope of work.

1.1.10 All equipment shall be designed for the initial throughput of 30 KLPD Ethanol/ENA. The Distillery Plant shall be capable of continuous operation for minimum 300 days.

1.1.11 The Design parameters to be used for the equipment design shall be as stated in the Distillery equipment specifications PART II, and in the specification for the individual items. In the event of any contradiction, the parameters used in the detail specification shall apply.

1.1.12 All pipe work and electrical distribution systems unless otherwise specified, shall be installed for the initial capacity of 30 KLPD Ethanol / ENA. Space shall be provided for future expansion.

1.2 PROJECT DESCRIPTION

1.2.1 The integrated project of Shri Vridheshwar Sahakari Sakhar Karkhana Limited (SVSSKL), Pathardi consists of the complete Distillery (RS/ENA/Ethanol & IS) plant and all associated infrastructure if any.

1.2.2 SVSSKL is proposing for the Project with a 12 TPH Slop fired Incineration Boiler.

1.2.3 The Cogeneration plant is proposed to produce power at a rate of approximately 1.2 MW.

1.2.4 Sugar Molasses based Distillery Plant will be designed to produce RS/ENA/Ethanol at 30 KLPD capacity.

1.3 WATER QUALITY

Raw water / Filter water / Soft water / DM water will be available at proposed water treatment plant. Supplier has to take the water from desired location with the approx. distance is 150 meter.

A. FILTER WATER: - Process water should be filtered and shall not contain any E.COLI or COLIFORM bacteria with total germs count being limited to 60 Nos/ml. The chloride content shall be less than 75 ppm.

Specifications: -

Parameters	Unit	Value
pH	----	6.5 -7.5
Chloride (Cl) Expressed as NaCl	mg/lit	<75
H2S	mg/lit	Nil
Residual Free Chloride	mg/lit	Nil
Silica(SiO2)	mg/lit	<75
Turbidity	NTU	<10
Total Germs	Nos/ml	<60 CFU
Coliform Bacteria	Nos/ml	Nil
E .Coli	Nos/ml	Nil

B. SOFT WATER: - (Cooling Tower make up water, Dilution Water for Decanters, Alcohol Scrubbers, Vacuum Pumps sealing Water)

Specifications: -

Parameters	Unit	Value
pH	----	6.5 -7.5
Turbidity	NTU	<10
Residual Free Chlorine	mg/lit	<0.5
Reactive Silica as SiO2	mg/lit	<50
Chloride as Cl-	mg/lit	<75
Hydrogen Sulfide as H2S	mg/lit	Nil
Total Hardness as CaCO3	mg/lit	<5
Total Dissolved Solids (TDS) as Ions	mg/lit	<250
Total Suspended Solids (TSS)	mg/lit	<10
Sulphates as SO4	mg/lit	<30

C. DM WATER: -

Specifications: -

Parameters	Unit	Value
pH	----	6-9
Hydrogen Sulfide as H_2S	mg/lit	Nil
Residual Free Chlorine	mg/lit	< 1
Total Hardness as $CaCO_3$	mg/lit	< 2
Total Dissolved Solids (TDS) as Ions	mg/lit	< 2

1.4 PROCESS DESCRIPTION:

Cane Juice / B-Molasses/ C-Molasses from the sugar factory is used as raw material, with help of yeast propagation and then fermentation, fermentable sugar get converted into Ethyl Alcohol / ENA. The fermented wash after clarification is feed to distillation system to get different product & alcohol further dehydrated to produce ethanol. Spent wash and spent lees generated in distillation is further treated as in effluent treatment plant, multi stage evaporation is proposed. Concentrated spent wash is then feed to incineration boiler along with supporting fuel like bagasse/coal.

The main plant shall be designed for producing 30 KLPD total Ethanol / ENA with its molasses composition more particularly fermentable sugar with a variation of ± 5 % quantity and quality

Capacity: 30 KLPD Ethanol @ 99.8% v/v or 30 KLPD ENA @ 96.2% v/v

Sr. No	Product	Production Liters/Day	Speciation v/v % Alcohol
1	Rectified spirit	(Minimum) 30,000	95
2	Extra Neutral Alcohol	(Minimum) 30,000	96.2
3	Impure spirit	(Maximum) 1,500	94.68
4	Ethanol	(Minimum) 30,000	99.8

Design Basis:

This section intends to specify the basis for the design of Ethyl Alcohol / ENA plant based on molasses fermentation and distillation. Process and minimum essential requirement for stable and consistent performance of the plant for minimum 300 days every year operation.

Basis for Selection

1. The plant shall be designed for fermentation and distillation process from molasses more particularly having fermentation sugar 40 % weight basis and above.
2. Ethyl Alcohol / ENA (Distillery) plant is ONE number for 30 KLPD total Ethanol / ENA capacity, operates continuously, with highest possible product purity and efficiency.
3. Ethyl Alcohol / ENA (Distillery) plant shall be designed to operate round the clock throughout the year for minimum 300 days.
4. The sludge contents in concentrated slop (to be fed to Incineration Boiler) to be below 5000 mg / Kg. Bidder to ensure best sludge separation system to be designed / installed to achieve the said sludge content level, even molasses quality may vary.

The plant shall be designed, manufactured and approved latest amendments of applicable process and Mechanical design, statutory regulation and safety aspect for plant itself and environment considering all five principle of Engineering.

1.5 General Information

1.5.1 Capacity and Performance

Sr. No	Product	Production Liters/Day	Speciation v/v % Alcohol
1	Rectified spirit	(Minimum) 30,000	95
2	Extra Neutral Alcohol	(Minimum) 30,000	96.2
3	Impure spirit	(Maximum) 1,500	94.68
4	Ethanol	(Minimum) 30,000	99.8

1.5.2 Quality of Power Generation & Distribution from Incineration Boiler & Steam Turbine

i.	Generation - Voltage V	11 KV
	- Phase	3
ii.	Distribution Voltage	415
	- Frequency Hz	50 (±2%)

1.5.3 Storage Requirements

i.	Molasses	Statutory requirement, 1.5 to 2 months
ii.	Rectified Spirit	Statutory requirement, 1 month
iii.	Ethanol	Statutory requirement, 1 to 1.5 months

Note: - Clarified Cane Juice/Cane Syrup shall be taken in day feed tank during cane juice to ethanol operation. The cooling arrangement for Cane juice/Cane Syrup shall be in bidder's scope.

1.5.4 Steam Consumption

Designed steam consumption of Distillery Plant	As mentioned in the performance guarantee Ref: Section 8

1.5.5 Project Commissioning

The project to be commissioned within 8-months from signing of contract/release of first advance whichever is later.

1.6 DESIGN CONCEPT

Further to the scope of statement, the Bidder shall develop the design of the plant to enable manufacture, fabrication, construction, installation and operation of all items of equipment.

Initially the Bidder will submit the Design Basis Report (DBR) and based on the approved DBR, the detailed specifications and drawings will be provided as part of these Contract documents. The Bidder shall, however, develop detailed designs of all aspects of the Distillery plant including construction, process system, mechanical, electrical, and control system design.

In conducting all aspects of the design, the same shall ensure achieving the desired performance of the Distillery plant detailed in Section 7.

Consideration shall be given to the efficiency of each unit of equipment and overall thermal and process efficiency of the Distillery Plant.

1.7 MECHANICAL AND ELECTRICAL DESIGN

The standards used in the design of mechanical and electrical plant shall be in conformity with the standards and the detailed plant specifications in section 3. Design considerations in the use of materials shall be as outlined in section 2 above. Mechanical & Electrical plant shall be designed to enable all of the requirements of the Distillery Plant. The Design basis and specifications shall be indicated clearly in the drawings.

1.8 CIVIL & STRUCTURAL DESIGN

1.8.1 Introduction

The Bidder is required to carry out the design for its Distillery Plant and machinery for the civil (load data) and structural works for its supply. Plant layout drawings issued with this bid document only provide to a guide line basis for tendering. The Bidder is required to develop the civil (load data- Dynamic and Static) and structural design to ensure compatibility with the equipment to be supplied and that safe limits for loading of foundations and structures are not exceeded. The standards for civil and structural works shall be as generally given in section 7.

The structural steel and machinery staging requirements shall be as specified in section 7 and the structural works, including miscellaneous fittings and finishes, shall be as given in these specifications. The Bidder will have to vet the civil engineering drawings for constructions which will be provided by client based on load data, drawings & information provided by the Bidder.

1.8.2 Design loads

a) General: Design loads shall generally be taken from Indian Standards except where otherwise stated in other design sections.

b) Wind Loading: Wind loading shall be calculated in accordance with Indian Standard taking due account of conditions prevailing at the project site.

c) Earthquake Loading: Structures to be designed for resistance to seismic forces.

1.8.3 Structural steel work design & supply

Structural steelwork design shall generally be in accordance with Indian Standard and using rolled steel sections Grade IS 2062 and to be supplied accordingly.

1.9 BATTERY LIMITS

Most of the activities and works related to this Contract will be performed within the factory fence indicated on the site plan and as mentioned in the Section 10 Terminal Points.

SECTION – 2

2.1 PROCESS DESIGN & INSTALLATION REQUIREMENT

Engineering, Procurement, Construction (EPC) supply to Shri Vridheshwar S S K Ltd. (SVSSKL) site, erection and commissioning, with the Bidder bearing full responsibility for performance as per specifications, of complete main Plant fermentation, Distillation, Evaporation, Storage and balance of plant (Mechanical, Electrical & Instrumentation) on turnkey basis.

The main plant includes fermentation, Distillation, Dehydration, Integrated & Standalone Evaporation and Balance of Plant (Mechanical) MBOP forms part of the proposed molasses based distillery plant of 30 KLPD total Ethanol / ENA capacity being established by the Shri Vridheshwar S S K Ltd. (SVSSKL), At Post-Adinath Nagar, Tal – Pathardi, Ahamadnagar.

The plant & machinery included in the scope of supply detailed in the specifications but it is the total responsibility of the EPC Bidder to ensure completeness of supply within the terminal points defined in chapter 10. Hence any Plant & machinery, equipment not specifically included in the specifications or any details of included specification, but required for ensuring completeness of supply and a fully working installation with performance, are to be included by the Bidder.

2.2 DESIGN PARAMETERS

The main plant shall be designed for producing 30 KLPD total Ethanol / ENA with its Cane Juice/B-molasses/C-molasses, composition more particularly fermentable sugar with a variation of ± 5 % quantity and quality.

Capacity: 30 KLPD total Ethanol / ENA

Sr. No	Product	Production Liters/Day	Speciation v/v % Alcohol
1	Rectified spirit	(Minimum) 30,000	95
2	Extra Neutral Alcohol	(Minimum) 30,000	96.2
3	Impure spirit	(Maximum) 1,500	94.68
4	Ethanol	(Minimum) 30,000	99.8

2.3 EVAPORATION:

Design Basis

This section intends to specify the basis for the design of Ethyl Alcohol / ENA (distillery) plant based on molasses fermentation, distillation and evaporation. Process and minimum essential requirement for stable and consistent performance of the plant for minimum 300 days every year operation.

Sr. No.	Specifications	Details
1.	Capacity:	13125 LPH
2.	Initial Solids	15% w/w solids
3.	Final Solids	60% w/w solids
4.	Feed pH	4 to 4.5
5.	Steam pressure & temperature	1.5 Bar (g) /116 Deg. C
6.	Evaporation Rate	9844 LPH
7.	Concentrated product out.	3281 LPH

2.4 BASIS FOR SELECTION

1. The plant shall be designed for fermentation and distillation process from Cane Juice cum Syrup, C-molasses and B-molasses more particularly having fermentable sugar as mentioned below.
   a. In cane juice cum syrup, sugar concentration is 10.50 to 11% weight basis.
   b. In C- molasses 40% weight basis and above.
   c. In B heavy molasses 55% weight basis and above.

2. Ethyl Alcohol / ENA (Distillery) plant is ONE number for 30 KLPD total Ethanol / ENA capacity, operates continuously, with highest possible product purity, yield and efficiency. All Pump & piping, instrumentation, electrification etc. designed for 30 KLPD total Ethanol / ENA.
3. Ethyl Alcohol / ENA (Distillery) plant shall be designed to operate round the clock throughout the year for minimum 300 days.
4. The Distillery plant shall be designed for Multi pressure distillation with integrated evaporation.
5. The Multiple effect evaporation plant shall be Integrated followed by standalone evaporation. The evaporation system shall be designed for raw spent wash of 315 m3/day (v/v) as feed.

6. The distillery plant be shall be designed for Zero Liquid discharge (ZLD),by adopting condensate polishing unit for treatment of process condensate& lees, can be recycle to process plant area.
7. The Multiple effect evaporation plant shall be designed such that concerted spent wash can be used in boiler along with supporting fuel like coal or bagasse.
8. The sludge contents in concentrated slop (used in Incineration Boiler) to be below 5000 mg / Kg. Bidder to ensure best sludge separation system to be designed / installed to achieve the said sludge content level, even molasses quality may vary.

The plant shall be designed on latest technology, manufactured and approved latest amendments of applicable process and Mechanical design, statutory regulation and safety aspect for plant itself and environment considering all five principle of Engineering.

2.5 SPECIFICATION FOR THE RAW MATERIAL

C Molasses: Molasses will be free from any foreign material including any calcium product and known inhibitory elements of yeast metabolism i.e. lead, iron, poly electrolytes etc. or microorganism producing side products. Such available molasses will be Brix of 85, pH 5, color will light brown to dark brown.

S No	Characteristics	Standard	Result
1	Total reducing sugars(%) by weight	>50.00	53.96
2	Degree Brix	>85.00	91.60
3	P^H of molasses	4.5 -5.2	5.52
4	Un fermentable sugars	<5.0	4.00
5	Fermentable sugars	>40.00	49.96
6	F/N Ratio	>1.00	1.04
7	Sludge content in %	<10.0	8.00
8	Titrable volatile acids (PPM)	<5000	5142
9	Calcium as CaO	1.5-3.0	1.80
10	Sulphated ash	<10.00	12.04
11	Specific gravity	1.40-1.45	1.42

Note: The above composition is indicative and vary with source for molasses.

B heavy: B heavy will be free from any foreign material and known inhibitory elements of yeast metabolism i.e. lead, iron, poly electrolytes etc. or microorganism producing side products. Such available B heavy will be Brix of 85, pH 5, color will light brown to dark brown.

S No	Characteristics	Standard	Result
1	Total reducing sugars(%) by weight	>55.00	56.36
2	Degree Brix	>90.00	81.60
3	P^H of molasses	4.5 -5.2	5.67
4	Un fermentable sugars	<5.0	1.90
5	Fermentable sugars	>40.00	54.46
6	F/N Ratio	>1.00	1.60
7	Sludge content in %	<10.0	6.00
8	Titrable volatile acids (PPM)	<5000	4770
9	Calcium as CaO	1.5-3.0	1.60
10	Sulphated ash	<10.00	13.04
11	Specific gravity	1.40-1.45	1.46

Note: The above composition is indicative and vary with process & parameter in sugar process.

Cane Juice:

S NO	Characteristics	Result
1	Brix	18.64
2	Pol	15.75
3	Purity	84.50
4	Sugar Concentration	----

2.6 SPECIFICATION FOR THE PRODUCT

Indian Standard Specifications for Rectified Spirit (IS: 323)

Sr. No	Characteristics	IS Standard
1	Specific gravity at 15.6^0 / 15.6^0 C	0.8171
2	Ethanol content % by Volume at 15^0 C Min	94-96
3	Miscibility with water	Miscible
4	Alkalinity	Nil
5	Acidity (as acetic acid) % by Wt. Max	0.002
6	Residue on Evaporation % by Wt. Max	0.005
7	Aldehyde Content (as CH3CHO) gm/100ml Max	0.006
8	Copper (as Cu g/100ml) Max	0.0004
9	Methyl Alcohol Mg/Ltr. Max	To satisfy the requirement of test
10	Lead as pb, gm/100 ml. Max	0.0001
11	Fusel oil content	To satisfy the requirement of test
12	Furfural content	To satisfy the requirement of test
13	Appearance	Crystal Clear & Bright

Indian Standard Specifications for Extra Neutral Alcohol (IS: 6613)

Sr. No	Characteristics	IS Standard
1	Specific gravity at 20^0 / 20^0 C	0.8069
2	Ethanol content % by Volume at 15^0 C Min	96.00 Min
3	Miscibility with water	Miscible
4	Alkalinity	Nil
5	Acidity (as acetic acid), gm/100ml Max	1.50
6	Residue on Evaporation, gm/100ml Max	1.50
7	Aldehyde Content (as CH_3CHO) gm/100ml Max	0.0005
8	Ester as $CH_3COOC_2H_5$, gm/100 ml, Max.	1.30
9	Copper (as Cu g/100ml) Max	0.002
10	Methyl Alcohol g/100 ml. Max	5.00
11	Lead as pb, gm/100 ml. Max	0.10
12	Higher alcohol as Iso-amyl alcohol, gm/100 ml, Max.	30.00

Sr. No	Characteristics	IS Standard
13	Furfural content	Not Detectable
14	Appearance	Crystal Clear & Bright
15	Permanganate Reaction Time, Minutes	50 (Min.)

Indian Standard Specifications for Ethanol (IS: 321-1964)

Sr. No	Characteristics	IS Standard
1	Specific gravity at 15.6^0 / 15.6^0 C	0.7961
2	Ethanol content % by Volume at 15^0 C Min	99.5
3	Miscibility with water	Miscible
4	Alkalinity	Nil
5	Acidity (as acetic acid) gm/100 ml Max	0.006
6	Residue on Evaporation % by Wt.Max	0.005
7	Aldehyde Content (as CH3CHO) gm/100ml Max	0.10
8	Copper (as Cu g/100ml) Max	0.0004
9	Conductivity us /m, Max	300
10	Methyl Alcohol / ENA Mg/Ltr.Max	300
11	Appearance	Crystal Clear & Bright
12	Denaturant as DEP 1%	--
13	Strength	74.2

2.7 BRIEF SPECIFICATION /REQUIREMENTS

A) ETHYL ALCOHOL / ENA (DISTILLERY) PLANT:

1. Installed capacity of distillery plant shall be designed for one plant operating at 100% capacity with consistent performance and product purity.
2. Installed plant of Ethyl Alcohol / ENA (Distillery) shall be inbuilt provision to produce Rectified spirit, ENA and Ethanol.
3. Plant to be designed considering the using of cane syrup having pol in cane 10.5 to 11% & above on weight basis and above.
4. Plant to be designed considering the using of C-molasses having concentration of fermentable sugar 40% on weight basis and above.

5. Plant to be deigned considering the using of B heavy molasses having concentration of fermentable sugar 55% on weight basis and above.
6. Plant has to design consider usage of different composition of molasses without affecting the plant performance and product quality.
7. Plant has to be designed with proper hazardous classification for raw material and products, HAZOP study.
8. Plant has to be designed and instrumentation to provide considering all condenser are on operating floor and reflux will be by pump.
9. Structure will be provided only up to operating floor and wherever require around the process columns for routine maintenance in distillation area.
10. All necessary changes in either equipment or in piping including all the control valves & its operations from DCS while switching over from Rectified spirit to ENA or Ethanol.
11. Directive and guidelines for Fire and safety measure for plant and storage area and PESO guidelines for entire Distillery Plant.
12. Bidder shall ensure, while designing the plant, for eco-friendly environment.
13. Bidder shall ensure, plant layout will be as per all statutory rules and regulation more particularly factory inspector.

2.8 ALCOHOL STORAGE:

1. Installed storage shall be designed for mentioned tank capacity at 100% load and different products.
2. Storage area has to be designed with proper hazardous classification for different product.
3. Rectified Spirit & ENA Daily receiver shall be installed inside the building and shed.
4. Rectified spirit & Extra Neutral Alcohol Bulk storage will be in open area with proper fencing as per applicable rules.
5. Ethanol (@ 99.8% v/v) storage Equipment layout, Elevation, tank construction, loading point and safety measures will be as per PESO rules 2002.

6. All pumps are provided with flame proof motors.
7. All pumps are installed inside the building and shed.
8. Bidder shall ensure, plant layout will be as per all statutory rules and regulation more particularly factory inspector.

2.9 MULTI EFFECT EVAPORATOR SYSTEM:

1. Installed capacity of Evaporator system shall be designed for one plant operating at 100% load with consistent performance and solid concentration with steam economy.
2. Evaporator system to be deigned considering the using of raw (molasses) spent wash having solid concentration of *15-16% to concentrated spent wash having concentration *58-60% on w/w basis, continuously.
3. Plant has to design consider variation in solid concentration in spent wash composition without affecting the plant performance, steam economy.
4. Plant has to be designed with proper hazardous operability (HAZOP study).
5. Bidder shall ensure for consistent steam economy for molasses based spent wash.
6. Bidder shall ensure Optimized power consumption
7. Evaporator & condenser spent wash piping, condensate piping, vacuum &vent piping shall be complete in SS 304.
8. Bidder shall ensure & consider outlet of integrated evaporation spent wash for removal of dissolved gases, for successful evaporator performance.
9. Bidder shall ensure Plant design is worked out on continuous basis.
10. Bidder shall ensure Plant design worked out with minimum time for CIP.
11. DCS system is offered for smooth operation of plant.
12. All electrical including PCC, MCCs, Lighting, Earthing & Lightning Protection and electrical cables are included.

13. Entire Instrumentation including Level / Pressure / Temp / Flow, etc. control loops in all effects & vessels are to be provided.
14. Directive and guidelines for Fire and safety measure for plant and storage area and PESO guidelines.
15. Plant has to be designed to such operation shall not adverse effect on environment.
16. Bidder shall ensure, plant layout will be as per all statutory rules and regulation more particularly factory inspector.
    a. *Solid concentration in the feed will be confirmed by distillation/integrated plant Bidder.
    b. **Solid concentration in concentrated spent will be confirm on the requirement of incineration type boiler plant Bidder.

2.10 MECHANICAL BALANCE OF PLANT

1. Raw water/Filter water/Soft water/DM water lifting from proposed WTP plant.
2. Water quantity is to be calculated based on consumption of total water as Process water, cooling tower make up, Steam generation, Washing, cleaning and misc.
3. Bidder shall consider the water requirement for start-ups, Stable operation, recycling of different stream, rejection at water treatment plant, and peak loads requirement.
4. Molasses unloading facility for procured molasses like unloading pit and pump and piping.
5. Molasses storage shall be designed considering two tanks for final molasses with separate pumps and piping.
6. Molasses storage shall be designed considering two tanks for C molasses and one tank of B Heavy molasses with separate pumps and piping.
7. Bidder shall consider live steam, temperature and pressure, turbine exhaust, PRDS for turbine bypass, considering the requirement of temperature and pressure of steam for process.

8. Bidder shall consider Steam condensate generation from Distillation & evaporation, where ever steam is used and provide at the outlet flange of steam condensate transfer pump, the required head will be provided during detailing. SVSSKL will take back this to Boiler as feed water considering the distance system pressure and pressure at feed tank, system is to be designed.
9. System Installed capacity of distillery plant shall be designed for one plant operating at 100 % load with consistent performance and product purity.
10. Installed plants/ Auxiliaries shall be inbuilt provision to consider the peak load requirement and plant operate at lower turndown.
11. MBOP has to be designed with proper hazardous classification.
12. All necessary changes in either equipment or in piping while switching over from one product to another, to change the source and all operational flexibility, emergency & all these provision stepwise documented separately.
13. Directive and guidelines for Fire and safety measure for plant and storage area and PESO guidelines for entire Distillery Plant.
14. Bidder shall ensure, while designing the plant, for friendly environment.
15. Bidder shall ensure, plant layout will be as per all statutory rules and regulation more particularly factory inspector.

2.11 SCOPE & REQUIREMENT:

The entire Distillery Plant shall be complete more particularly including items mentioned below:

1. All equipment like Tanks, vessels, Fermenters, distillation columns, Reboilers, Condensers, Preheaters, Coolers, Decanter, Reflux holding tank, Pumps, cooler, Piping, Storage tank etc. with proper supporting, painting, insulation and labelling.
2. Integral piping with proper supporting, Insulation, Painting, Labelling.
3. Hot insulation as per IS standard.
4. All control valves shall have bypass valve and isolation valve arrangement for maintenance of instrumentation.

5. All integral piping for Process lines, steam, cooling water supply return, Process/soft water, service and instrument air, process piping, condensate, effluent piping.
6. Instrumentation and control shall be suitable for total operation for plant and storage through DCS.
7. Steam flow meter and totalizer.
8. All requisite valve and proper valve selection.
9. All vents to elevated at safe location.
10. All drain to connected to nearby gutter.
11. All electrical power cabling from PCC onwards including PCC.
12. All signal and control cabling from Distillery plant and its equipment up to plant, DCS marshalling cabinet about 100 mtr distance.
13. All other supporting auxiliaries and plant components required for safe, reliable and continuous year round production of Ethyl Alcohol / ENA and evaporation for spent wash concentration.
14. All equipment will be designed and manufactured as per ASME section VIII
15. The centrifugal pumps and accessories shall be design, manufactured and tested as per API 610. The screw pumps and accessories shall be design, manufactured and tested as per API 676.
16. All heat exchanger and re-boiler will be designed as per TEMA.
17. All storage tanks will be designed & manufactured as per API 650.
18. Bidder shall identify all critical lines and ensure all lines will be safe in operation.
19. Bidder shall mention the life of the plant.
20. Erection and commissioning tool & tackles and requisite spares shall be considered by Bidder.
21. Bidder shall consider suitable Material of construction, proper composition considering fluid properties and process parameters.
22. Bidder shall furnish all necessary engineering data /drawing, operating philosophy and trip logic for Ethyl Alcohol / ENA plant, evaporation and for integration with other section of plant DCS system.

23. The design, Manufacturing, Inspection, supply, construction, testing and performance of the distillery plant and its accessories shall comply with the requirement of applicable latest Indian Standard. Bidder shall furnish a quality assurance plan for review and approval by client/ consultant and strictly comply with the approval quality plan.
24. Bidder shall ensure proper supporting, painting, insulation, labeling, accessibility and maintainability for equipment and instruments.
25. Bidder shall ensure proper area to be kept for man movement, piping area, staircase, and maintenance area bay.
26. Required plant air conditioning for Control Room including auxiliary cooling tower, water cooled. Bidder to provide heat load calculation during engineering. Scroll type compressors to be provided with required air duct, dampers, louvers, insulation, false ceiling, required copper tubing, cooling water system, auto temperature control etc. Capacity of the units to be chosen to have one spare unit of about 20% capacity.
27. Obtaining all required statutory approvals for construction of Distillery plant including PESO, electrical inspectorate approval, IBR approvals, labour commissioner, excise, factory inspector as applicable, electrical inspector for electrical works, registration & payment of all taxes & duties for Bidders' staff & labour, as per all applicable laws, etc. Statutory fees, if any, will be paid by the Purchaser and applications required.
28. The scope of work not mentioned in this tender document but essential for successful commissioning and operation of the plant is to be considered in the scope by the Bidder.

2.12 Mechanical Balance of Plant (MBOP) shall be complete more particularly including items mentioned below:

1. All equipment/ Auxiliaries like Molasses storage tanks and pumps, cooling tower for fermentation, distillation, evaporation and pumps, Piping, Storage tank etc. with proper supporting, painting, insulation, labeling.
2. PRDS, Steam distribution and condensate handling, piping with proper supporting, insulation, Painting, Labeling.

3. Raw and treated Spent wash, pumps and handling Piping, Storage tank etc. with proper supporting, painting, insulation, labeling.
4. Spent lees collection & handling tank, pumps and piping
5. Compressor, accessories and piping
6. Fire water pump, piping and equipment as per Fire & Safety guidelines.
7. All control valves shall have bypass valve and isolation valve arrangement for maintenance of instrumentation.
8. All integral piping for Process lines, steam, cooling water supply return, Process/soft water, service and instrument air, process piping, condensate, effluent piping.
9. Instrumentation and control suitable for total operation for balance of plant through DCS.
10. All requisite valve and proper valve selection
11. All vents to elevated at safe location
12. All drain to connected to nearby gutter.
13. All electrical power cabling from PCC/MCC on onwards to respective driving
14. All signal and control cabling from respective section plant and storage and its equipment up to plant, DCS marshaling cabinet
15. All other supporting auxiliaries and plant components required for safe, reliable and continuous year round operation for distillery. *confirmed based on layout.
16. All equipment will designed & manufactured as per ASME section VIII.
17. All pumps will designed and manufactured as per ASME.
18. All heat exchanger and re boiler will be designed as per TEMA std.
19. Bidder shall identify all critical lines, basis for critical line ensure for all lines will be safe in operation.
20. Bidder shall mention the life of the plant, resin, insulation etc.
21. Site fabrication, Erection and commissioning tool& tackles and requisite spares shall be considered by Bidder.
22. Bidder shall consider suitable Material of construction, proper composition considering fluid properties and process parameters.

23. Bidder shall furnishings all necessary engineering data /drawing, operating philosophy and trip logic for plant and if required for integration with respective section DCS system.
24. The design Material, construction, Manufacturing, Inspection, testing and performance of section of MBOP and its accessories shall comply with the requirement of applicable latest Indian Standard, Bidder shall furnish a quality assurance plan for review and approval by client/ consultant ad strictly comply with the approval quality plan.
25. Bidder shall ensure proper supporting, painting, insulation, labeling, accessibility, maintainability for equipment and instruments.
26. Bidder shall ensure proper area to be kept for man movement, piping area, staircase, ladder, flat form, railing, maintenance area bay.
27. Pipe rack shall consider all process and utility piping, load for insulation, instrument and electrical cable, mountings, loops.
28. Yard piping and pipe rack shall consider man movement, vehicle and crane movement while road crossing.
29. Proper culverts/casing to be provided for underground piping while crossing the road, storm water drain, gutters.
30. Firefighting system shall be designed considering all fluids, material are present and to be handled in the plant.
31. Firefighting system shall be designed considering other underground piping, storm water and gutters.
32. Firefighting system to be included fire pump house, suitable size piping and nozzles (to be common for distillery & Incineration boiler cogen and to be designed accordingly). Bidder to keep provision for piping extension with tap arrangement at suitable location (to be mutually finalized during detail engineering) for use of Incineration Cogen plant

2.13 Electrical Balance of Plant (EBOP) shall be complete more particularly including items mentioned below:

1. All equipment/Auxiliaries like PCC, MCCs, Panels, and Cabling with cable accessories, Illumination, Earthing & Lightning Protection shall be part of the scope of this contract.
2. Design, manufacture, supply, erection, testing & commissioning of following electrical equipment & systems shall be considered,
   i. Main LT PCC with Incoming ACB & Outgoing ACB / MCCB feeders, metering, indications & protection for various loads / MCCs in plant.
   ii. Bidder to consider, Incomer Feeder for Emergency DG set power supply in PCC and its cabling from outgoing feeder from DG set panel (Incineration cogen scope)
   iii. 415V MCCs as per section wise loads for following as min.,
      a. Molasses Storage & handling
      b. Fermentation Plant
      c. Distillation Plant
      d. Ethanol Plant
      e. Finished Product Day Receivers and Bulk Storage
      f. Utility MCC
   iv. LT Power & Control cables, cable terminations & FRP cable trays with covers and all required accessories including supports.
   v. Illumination system with Lighting DB, SLDB, LED type lighting fixtures flame proof Lighting fixtures where ever required as per hazardous area classifications.
   vi. Earthing & Lightning Protection system as per relevant IS & applicable IEC for all buildings & structures within battery limits. All above /below ground Earthing with electrodes is in bidder's scope. Civil work & Earth pits is in Purchaser scope
   vii. Fire protection system for PCC/MCC room area as per statutory requirements.

2.14 Entire Instrumentation & Control System as mentioned below:

The entire plant will be controlled by a centralized DCS with high redundancy level with inputs and controls of all loops, analyzers, control valves, motorized valves, motors, etc.

The integration of all the inputs / signals for continuous monitoring, operation, data logging, data analysis, alarms, safety interlocks, annunciations etc. will be achieved through the DCS.

The DCS will include the DCS control station, related licensed software & hardware, instrument & control cabling from the marshalling cabinet receiving signals from junction boxes of all Sections & equipment, all MCC's and PCC.

The entire Distillery plant will be smoothly started, normally operated, provided with necessary interlocks & emergency trips, monitored, controlled and smooth shut down from the DCS.

DCS Hookup: From Incineration Boiler/ Cogen Plant DCS with required software & compatibility with internet so as to transfer daily / shift wise MIS to Management / Senior officers of Plant.

Basic Control Design should be as below:

i. Redundancy at entire IO level is not envisaged except 10% critical I/O's. All controllers for critical controls will be redundant. The field inputs for critical inputs will be1/2 logics.
ii. Required Annunciation windows shall be included
iii. 20% spare I/O's to be considered.
iv. All I/O's will be potential free

SECTION – 3

TECHNICAL SPECIFICATIONS - MAIN PLANT

3.1 FERMENTATION:

Fermentation technology uses Yeast, which will give desired performance under variable process parameter, Section-wise description is as below:

1. Molasses Handling and Distribution:

Screened molasses from bulk storage is transferred to molasses Day receiving tank and molasses is weighed. Weighed molasses is distributed to cell mass propagation, fermentation and yeast activation /recycling section.

2. Yeast propagation:

a. Yeast is grown in laboratory during plant start-up. Yeast propagation section comprises of molasses diluter and hygienically engineered yeast vessels equipped with heating, cooling and air sparging facility.

b. Dilute molasses media is prepared in yeast vessel by recirculation media through molasses diluter. Laboratory propagated cell mass is scaled up in series of yeast vessels.

c. Air is sparged in pasteurized and cooled dilute molasses medium for optimum growth of yeast. Temperature is maintained at 30^0 -32^0 by recirculation cooling water through jacket of yeast vessels. Cell mass from yeast vessel is transferred to pre fermenter vessel to increase cell mass required for fermentation by cell mass transfer pump. In some cases pre fermenter will be online continuously.

3. **Fermentation:**

a. Fresh biomass propagated in yeast propagation section is seeded in Fermenter.

b. Yeast converts fermentable sugars to alcohol and carbon dioxide under optimum condition. As alcohol fermentation is exothermic process, heat is released during the process. Dedicated forced recirculation fermented wash coolers for each fermenter cools the wash to maintain optimum temperature required for yeast activity. The fermented wash is then transferred through yeast settling tank or yeast separator.

4. **Alcohol Recovery and wash handling:**

a. Carbon dioxide generated in fermentation is entrained with alcohol vapors.

b. Alcohol from carbon dioxide is scrubbed with water in gas scrubber. The scrubber water is transferred to wash charger. Fermented wash from charger is fed to distillation.

5. **Auxiliaries:**

a. Auxiliary system comprises of dosing system for nutrient, antifoam, acid, sterile air supply for yeast activation and yeast propagation section.

6. **Utility:**

a. Cooling water is supplied to fermentation through cooling water system for fermentation.

b. Process water pumps supplies process water required for dilution of molasses in Fermenter and yeast activation vessel.

3.1.1 BRIEF TECHNICAL SPECIFICATIONS

FED-BATCH FERMENTATION SECTION:-

Sr. No.	Description	Capacity (Working Volume)	MOC	Thick (Bot/Shell /Top)	Qty
A	**MOLASSES HANDLING AND WEIGHING SYSTEM**				
1.	Molasses Day Storage Tank (The same tank can be used for B-Molasses/C-Molasses) Type – Vertical Cylindrical	135 MT	MS IS-2062	As per API 650	1
2.	Common Automatic Weighing System for C/B Molasses	7 MT/hr	Suitable	---	1
3.	Common Molasses Weighing Tank for C/B Molasses Type – Vertical Conical	2.5 MT	MS IS-2062	As per API 650	1
4.	Common Weighed C/B Molasses Tank Type – Vertical Cylindrical	20 MT	MS IS-2062	As per API 650	1
5.	Molasses Strainers	7 MT/hr	SS 304	5	2
6.	Cane Juice / Syrup Intermediate Tank Type – Vertical Conical	5 MT	MS IS-2062	As per API 650	1
7.	Cane Juice/Syrup Cooler Type – PHE	To be Specified	Plate – SS 316	To be Specified	1
8.	Cane Juice/Syrup Mass Flow Meter	5 MT/Hr	Wetted part SS 316	To be Specified	1

Sr. No	Particulars	MOC	CAP	HEAD (M)	KW	Qty (no)
B	**MOLASSES HANDLING – PROCESS PUMPS**					
1.	Screw pump day tank to molasses weighing system	SS 304 wetted parts	10 MT/hr	15	To be specified	1+1
2.	Screw pump with variable drive, molasses feed to fermentation	SS 304 wetted parts	10 MT/hr	25	To be specified	1+1
3.	Screw pump with variable drive, Cane Syrup feed to fermentation	SS 304 wetted parts	5 MT/hr	25	To be specified	1+1

Sr. No.	Description	Capacity (Working Volume)	MOC	Thick (Bot/Shell /Top)	Qty
C	**PRE FERMENTATION AND FERMENTATION**				
1.	Common Dilutor for culture vessels	To be specified	SS 304	3	1
2.	Molasses diluter for Pre-fermenter	To be specified	SS 304	3	2
3.	Molasses diluter for Fermenter	To be specified	SS 304	5	4
4.	Yeast Propagation Vessel with air sparging, jacket cooling arrangement & necessary fittings. Type – Vertical with Conical top & bottom	I – 0.10 M^3 II – 0.6 M^3 III –4.5 M^3	SS 304	3/3/3 3/3/3 3/4/3	1 1 1
5.	Prefermenter with air sparging, cooling arrangement, necessary fittings & Manholes Type – Vertical Cylindrical	30 m3	SS 304	As per API 650	1+1
6.	Fermenters should have slopping bottom with top mounted agitators, sight glass, level indicator & relief valve, Cleaning nozzles with other necessary fittings / nozzles etc.	210 M^3	SS 304	As per API 650	4

7.	CO2 Scrubber & internal sieve trays min 6 nos. Type – Vertical Cylindrical	To be specified	SS 304	3/3/3	1
8.	Wash settling holding tank preferably conical bottom with manhole, level indicator necessary fittings & nozzles	70 M^3	SS 304	As per API 650	1
9.	Sludge Trough with agitator, necessary fittings & nozzles	5 M^3	SS 304	3/3/3	1
10.	Sludge Decanter Type – Horizontal / Centrifugal	3 m3/hr	Wetted part – SS 316	-	1
11.	Clarified wash tank with sight glass, manhole, level indicator, cleaning nozzles with necessary fittings & nozzles	210 M^3	SS 304	As per API 650	1

Sr. No.	Description	Capacity (Working Volume)	MOC	Thick (Bot/Shell /Top)	Qty
D	**FERMENTATION SECTION : TANKS**				
1.	Antifoam Oil Tank	1.00 M^3	SS 304	3/3/3	1
2.	Nutrient mixing tank with agitator	0.50 M^3	SS 304	3/3/3	1
3.	Conc. Sulphuric acid tank	0.50 M^3	MS IS-2062	5/5/5	1
4.	CIP Tank	5 M^3	SS 304	3/3/3	1

Sr. No	Particulars	MOC	CAP	HEAD (M)	KW	Qty (no)
E	**PRE-FERMENTATION / FERMENTATION – PROCESS PUMPS**					
1.	Pre-fermenter cooling pump, centrifugal, double mech. seal	SS 304 wetted parts	30 m3/hr	20	To be specified	1+1
2.	Fermenter cooling pump, centrifugal, double mech. seal	SS 304 wetted parts	170 m3/hr	25	To be specified	4+1store stand by with Motor

Sr. No	Particulars	MOC	CAP	HEAD (M)	KW	Qty (no)
E	**PRE-FERMENTATION / FERMENTATION – PROCESS PUMPS**					
3.	Sludge Trough Tank pump	SS 304 wetted parts	3 m3/hr	20	To be specified	1+1
4.	Clarified wash tank to distillation	SS 304 wetted parts	20 m3/hr	55	To be specified	1+1
5.	Process water pump (type – Centrifugal)	SS 304 wetted parts	20 M^3/hr (min)	30	To be specified	1+1
6.	CIP Pump Type – Centrifugal double mech. seal	SS 304 wetted parts	5 M^3/hr	35	To be specified	1+1
7.	Antifoam Oil pump – Gear type	SS 304 wetted parts	1 m3/hr	20	To be specified	1+1
8.	Nutrient dosing pump, diaphragm type	SS 304 wetted parts	1.0 m3/hr	20	To be specified	1+1
9.	Conc. Acid dosing pump, diaphragm type	---	1.0 m3/hr	20	To be specified	1+1

Sr. No	Particulars	HTA Min.	MOC	THK	QTY (No)
F	**Pre-fermentation / Fermentation – Plate Heat Exchangers**				
1.	Prefermenter Coolers	To be specified	SS 304	0.5 mm	2
2.	Fermenter Coolers	To be specified	SS 304	0.5 mm	4

Note: CIP arrangements for PHE is to be provided where ever required.

Sr. No	Particulars	CAP	MOC	THK	QTY (No)
G	**Miscellaneous Equipment's**				
1.	Blower, twin lobe type provided with pre-filter & HEPA filter	To be specified	CI Body	-	1+1
2.	Strainer for dilute molasses	To be specified	SS 304	3 mm	1+1
3.	Water header	To be specified	MS	'C' Class	1

4.	Sealing water system comprising of pump, tank, PHE, piping etc	To be specified	SS 304	Suitable	1 Lot

H. Pre-Fermentation / Fermentation – Piping, Flanges and Valves				
Sr. No.	**Particulars**	**M.O.C.**	**Class / Schedule**	**Remark**
1.	a. Molasses b. Fermented wash c. Process & cooling water d. Process Air e. CO_2 f. Conc. Acid g. Steam piping h. Antifoam i. Instrument air	MS SS-304 MS SS-304 SS-304 HDPE MS SS 304 SS 304	‘ C ‘ Class SCH 10 ‘ C ‘ Class SCH 10 SCH 10 As per IBR SCH 10 SCH 10	For SS-304 Piping- Sch. 10 to be provided for all sizes pipes
2.	Valves- a. Molasses b. Fermented wash c. Process & cooling water d. Air e. Acid f. Steam g. Antifoam	 BFV/BV BFV/BV BFV/BV BFV/BV BFV/BV BV/GV/ Globe BV		Butterfly valve: SG Iron body, SS 316 Disk, EPDM Seat. Ball valve : SS body, SS internals Ball valve : up to 40 NB Butterfly : above 40 NB Globe/Gate Valve: CI body, SS internals.

Note-

- List of equipment is tentative and may change with technology offered.
- Motor capacity design data as per load to be submitted.
- Pumps-1+1 Nos. (1 No. in operation + 1 No. standby)
- Non return valves (NRV) should be provided for each pump delivery line.
- Pressure gauge should be provided for each pump
- Safety guards for the coupling.
- Complete sealing/flushing water system with tank, pump etc.
- All flanges should be as per ASME/ANSI B 16.5.
- All tanks should be as per API 650.
- All ball valves should be full port type only.
- For piping every 12M distance flanges should be provided.
- For SS-304 Piping- All piping shall be in Sch. 10.
- *To be specified – Bidders to provide details.

3.2 DISTILLATION:

- Bidder shall ensure Wash to ENA Mode:

  Following Columns and conditions for operation:

  - ❖ Analyzer & De-gassifier Column: Operates under vacuum.
  - ❖ Pre Rectifier cum Exhaust Column: Operates under pressure
  - ❖ Extractive distillation Column: Operates under pressure/Atmospheric
  - ❖ Rectifier cum Exhaust Column: Operates under pressure
  - ❖ Recovery Column: Operates under pressure/Atmospheric
  - ❖ Refining Column: Operates under Vacuum/Atmospheric
- Energy efficient Multi-pressure Distillation system with minimum steam consumption & should not exceed of 3.20 kg/lit of total spirit.
- Optimal heat integration to conserve energy and Pre heating fermented wash for proper stripping of alcohol vapors.
- Under vacuum to pressurized operation nearly eliminates scaling problem in wash column and ensures better separation of impurities, which result into better quality product.
- Well engineered plants with high efficiency trays to ensure elaborate separation and removal of impurities ensuring superior quality of spirit and Proper separation of fusel oils with helps of Fuels oil decanter.
- Bidder shall ensure design of calming zone on trays, large area of down-comers, gas-liquid separators with tangential entry and vapor bottles ensures proper gas-liquid disengagement and eliminates chances of liquid carryover.
- Wash column with Rh grid trays ensure high turbulence on tray, to take care minimum scaling.
- Bidder shall ensure easier cleaning of wash column internals construction of trays and access to each tray help in easier cleaning of column internals. Bidder shall ensure glass protector for manhole and SG/LG glasses for distillation column where ever required.
- Bidder shall ensure distillation system along with integrated evaporation system.

BRIEF SPECIFICATION FOR DISTILLATION SECTION:

Distillation Section – Multi – Pressure Distillation System

Sr. No.	Particulars	Diameter Min. (mm)	M.O.C. (Shell, Trays, caps, dish, down comers, etc.)	No. of Trays, tray spacing, type of tray	Thk Shell/ Tray/Cap (mm)	Qty. (no)
A.	**DISTILLATION COLUMNS**					
1.	Analyzer/ Wash column	To be Specified	SS 304	18 nos. (min) 750 mm Rh grid	4/2.5 (min)	1
2.	Degasser Column	To be Specified	SS 304	6 nos. (min) 750 mm Rh grid/Sieve	3/2.5	1
3.	Pre Rectifier Column	To be Specified	SS-304	64 nos. (min) 250 mm Bubble Cap	4/2.5/1.6	1
4.	Extractive Distillation Column	To be Specified	SS-304	45 nos. (min) 250 mm Bubble Cap	4/2.5/1.6	1
5.	Rectifier –II column	To be Specified	SS-304	72 Trays (min) 250 mm Bubble cap (Top 32 Trays in Dow Cu)	4/2.5/1.6	1
6.	Recovery Column	To be Specified	SS 304	50 nos. (min) 250 mm Bubble Cap	4/2.5/1.6	1
7.	Refining Column	To be Specified	Do Cu	50 nos. (min) 250 mm Bubble Cap	4/3/1.6	1

Note:-

1 Necessary Manholes to be provided for the columns along with sight & light glasses.
2 Necessary connections like manometer, vapor bottle, anti-vacuum valve etc. to be provided to the column.
3 Proper arrangement to be provided for cleaning Degassifier and Wash Column.
4 Please elaborate the cleaning arrangement for trays in the Wash column.
5 Process columns & internals to be designed as per ASME Section VIII.

Sr. No.	Particulars	H.T.A. Min. (M^2)	M.O.C. (Shell, bonnet, tubes, etc.)	Tube Thickness in mm/ Tube OD in mm / tube length (M)	Shell thk. (mm)	Qty (Nos)
B.	**DISTILLATION SECTION – RE-BOILERS, CONDENSER, COOLERS**					
1.	Analyzer /Wash Column Reboiler	To be Specified	SS 304	1.6 / 38 / 3	3	1W+ 1SB
2.	Pre Rectifier Column Reboiler	To be Specified	SS 304	1.6 /25.4 / 3	3	1
3.	ED Column Reboiler	To be Specified	SS 304	1.6 /25.4 / 3	3	1
4.	Rectifier – II Column Reboiler	To be Specified	SS 304	1.6 /25.4 / 3	3	1
5.	Recovery Reboiler	To be Specified	SS 304	1.6 /25.4 / 3	3	1
6.	Refining Column Reboiler	To be Specified	SS 304	1.6 /25.4 / 3	3	1
7.	Analyzer Column condenser I	To be Specified	SS 304	1.2 /25.4 / 3	3	1
8.	Analyzer Column condenser II	To be Specified	SS 304	1.2 /25.4 / 3	3	1
9.	Analyzer Column condenser III	To be Specified	SS 304	1.2 /25.4 / 3	3	1
10.	Degasser condenser I	To be Specified	SS 304	1.2 /25.4 / 3	3	1
11.	Degasser condenser II	To be Specified	SS 304	1.2 /25.4 / 3	3	1
12.	Pre Rectifier Vent Condenser	To be Specified	SS 304	1.2 /25.4 / 3	3	1
13.	Pre Rectifier PCV Condenser	To be Specified	SS 304	1.2 /25.4 / 3	3	1
14.	Rectifier Vent Condenser	To be Specified	SS 304	1.2 /25.4 / 3	3	1
15.	Rectifier PCV Condenser	To be Specified	SS 304	1.2 /25.4 / 3	3	1
16.	ED Column Vent Condenser	To be Specified	SS 304	1.2 /25.4 / 3	3	1
17.	Recovery Column condenser I	To be Specified	SS 304	1.2 /25.4 / 3	3	1

Sr. No.	Particulars	H.T.A. Min. (M^2)	M.O.C. (Shell, bonnet, tubes, etc.)	Tube Thickness in mm/ Tube OD in mm / tube length (M)	Shell thk. (mm)	Qty (Nos)
B.	**DISTILLATION SECTION – RE-BOILERS, CONDENSER, COOLERS**					
18.	Recovery Column condenser II	To be Specified	SS 304	1.2 /25.4 / 3	3	1
19.	Refining Column condenser I	To be Specified	SS 304	1.2 /25.4 / 3	3	1
20.	Refining Column condenser II	To be Specified	SS 304	1.2 /25.4 / 3	3	1
21.	RS Cooler	To be Specified	SS 304	1.2 /25.4 / 3	3	1
22.	ENA Cooler	To be Specified	Shell Dow Cu, Tube SS 304	1.2 /25.4 / 3	3	1
23.	Impure Alcohol Cooler	To be Specified	SS 304	1.2 /25.4 / 3	3	2
24.	Fusel Oil + light oil Cooler	To be Specified	SS 304	1.2 /25.4 / 2	3	4

Note:

1. Condensers mentioned herewith are tentative and quantities may change with the distillation technology offered. Proper explanation to be given for deleting/adding any of the condenser or coolers.
2. All condensers must be provided with flow glasses and degasifying bottle.
3. All reboilers tube thickness to be 1.6 mm.
4. Shell thickness mentioned are minimum thickness. Provide higher thickness if necessary as per TEMA 'C" Class.
5. All flanges & bonnet for condensers, reboilers and coolers shall be SS 304.
6. Necessary arrangements for installing chain pulley block for lifting/removing condensers & reboilers to be provided.

Sr. No.	Particulars	Capacity	MOC	Thickness in mm	Qty (No.)
C.	**DISTILLATION SECTION - MISCELLANEOUS EQUIPMENT & TANKS**				
1.	Wash Pre heater (Plate heat exchanger)	HTA To be specified	SS 316	Plate Thick. 0.5	1+1
2.	Rectifier Column – II bottom lees Cooler (Plate heat exchanger)	HTA To be specified	SS 316	Plate Thick. 0.5	1+1
3.	DM water Heater (Plate heat exchanger)	HTA To be specified	SS 316	Plate Thick. 0.5	1+1
4.	Steam Header with pressure & temp gauge, safety valve, inlet / outlet steam valve etc.	To be specified	MS	IBR Approved	1
5.	Water Header	To be specified	MS	MS C class	1
6.	Hot water tank	2 m3	MS	5	1
7.	Steam condensate tank	2 m3	MS	5	1
8.	Fusel Oil washing tank	0.5 m3	SS 304	3	1
9.	Degasser Condensate tank	0.5 M^3	SS 304	3	1
10.	Analyzer Condensate tank	1.0 M^3	SS 304	3	1
11.	Pre Rectifier reflux tank	1 m3	SS 304	3	1
12.	Rectifier reflux tank	2 m3	SS 304	3	1
13.	ED reflux tank	0.5 m3	SS 304	3	1
14.	Recovery Feed Tank	0.5 m3	SS 304	3	1
15.	Recovery Reflux Tank	0.5 m3	SS 304	3	1
16.	Refining reflux tank	0.5 m3	SS 304	3	1
17.	IS collection Tank	0.5 m3	SS 304	3	1
18.	RS Product tank	0.5 M^3	SS 304	3	1
19.	Vacuum Pump Drum	0.5 M^3	SS 304	3	1
20.	Sealing water system for vacuum pump/PHE	To be specified	SS 304	-	1
21.	Vapor liquid separator for analyzer column	to be specified	SS 304	4	1
22.	Dilution Bottle for ED column	to be specified	SS 304	3	1
23.	Manometer Bottles	Where ever required	SS 304	-	Lot
24.	Vapor Bottles (For all condensers)	To be specified	SS 304	-	Lot
25.	Fusel Oil Decanter	to be specified	SS 304	3	4

Sr. No.	Particulars	M.O.C.	Remark
D.	**DISTILLATION SECTION: PIPING, FLANGES & VALVES.**		
1.	Piping a. Fermented wash b. Water c. Steam d. Rectified spirit e. Ethanol f. Impure spirit g. Fusel oil h. Spent wash i. Spent less	 SS 304 MS-C-Class MS-IBR SS 304 SS 304 SS 304 SS 304 SS 316 SS 304	For SS-304 Piping- Sch. 10 shall be provided for all sizes
2.	Valves a. Fermented wash b. Water c. Steam d. Rectified spirit e. Ethanol f. Impure spirit g. Fusel oil h. Spent wash i. Spent less	 SS 304 CI with SS internals CI with SS internals SS 304 SS 304 SS 304 SS 304 SS 316 SS 304	Ball Valve up to 40 NB Butterfly Valve 40 NB and above. SS 316 disk & EPDM Seat. Gate/Globe Valves: CI with SS Internals

Note:

1. All flanges should be as per ASME/ANSI B 16.5.
2. All ball valves should be full port type only.
3. Flanges should be provided at every 6 meters in the piping.

Sr. No.	Particulars	M.O.C.	Capacity	HP/KW	Qty	Remark
E.	**DISTILLATION SECTION – PROCESS PUMPS**					
1.	Spent wash transfer Pump	SS 304	18 m3/hr	To be specified	1+1	Double mech seal
2.	Analyser Condensate transfer pump	SS 316	4 m3/hr	To be specified	1+1	Double mech seal
3.	Degasser Condensate transfer pump	SS 316	2 m3/hr	To be specified	1+1	Double mech seal
4.	Pre Rectifier bottom (spent lees) transfer pump	SS 304	2 m3/hr	To be specified	1+1	Single mech seal

Sr. No.	Particulars	M.O.C.	Capacity	HP/KW	Qty	Remark
E.	**DISTILLATION SECTION – PROCESS PUMPS**					
5.	Pre Rectifier reflux pump	SS 304	5 m3/hr	To be specified	1+1	Single mech seal
6.	Rectifier bottom (spent lees) transfer pump	SS 304	12 m3/hr	To be specified	1+1	Single mech seal
7.	Rectifier reflux pump	SS 304	7 m3/hr	To be specified	1+1	Single mech seal
8.	ED Column Reflux Pump	SS 304	1.5 m3/hr	To be specified	1+1	Single mech seal
9.	Recovery Reflux Pump	SS 304	1.5 m3/hr	To be specified	1+1	Single mech seal
10.	Recovery Feed Pump	Wetted part SS 304	1.5 m3/hr	To be specified	1+1	Single mech seal
11.	Refining Column Reflux Pump	SS 304	3.00 m3/hr	To be specified	1+1	Single mech seal
12.	Refining bottom Pump	Wetted part SS 304	2.00 m3/hr	To be specified	1+1	Single mech seal
13.	IS collection transfer Pump	Wetted part SS 304	0.50 m3/hr	To be specified	1+1	Single mech seal
14.	Steam condensate Pump	CI	7.00 m3/hr	To be specified	1+1	Single mech seal
15.	Vacuum Pump	Wetted part SS 316	To be specified	To be specified	1+1	Single mech seal
16.	Sealing water system for pumps (supply & return header, tank, pump & PHE	SS 304	To be specified	To be specified	1 Set	

Note:-

1. All pumps should be provided with flameproof motors with mechanical seal (single/double) as required.
2. CIP tank installed in fermentation to be used in distillation for CIP purpose.
3. Non return valve to be provided for each pump.
4. Pressure gauge should be provided for each pump
5. Safety guard for all the motors.
6. All flanges to be confirmed to ASME/ANSI B 16.5.

7. Ball valves to be full bore.
8. Flanges to be provided at minimum distance of 12.0 meter piping.
9. All SS piping shall be schedule 10.
10. List of pumps is tentative and may change with distillery technology offered. Proper notes to be mentioned for any addition or deletion of pumps.

3.3 MOLECULAR SIEVE DEHYDRATION:

Rectified Spirit containing at least 95% v/v alcohol is pumped from RS collection tank to dehydration section. Rectified spirit is preheated in Feed preheater with the help of steam condensate and then fed to top tray of Evaporator Column. The objective of the Evaporator Column is to evaporate rectified spirit. The Evaporator Column operates under pressure. Energy is supplied to the Evaporator Column through Evaporator Column Re boiler with steam condensing on shell side. The steam condensate will be recycled back to the boiler.

Overhead feed alcohol vapors from the Evaporator Column are then passed through Super heater where alcohol vapors are superheated. Energy for superheating is supplied by steam condensation on shell side of the Super heater.

Superheated hydrous alcohol vapors *are* sent to twin Adsorbent Beds. The twin Adsorbent Beds operate in cyclic manner. Twin beds are provided to allow for bead regeneration in continuous operation. While one bed is in dehydration mode, the other is in regeneration mode. Depending on feed and product specifications, dehydration-regeneration exchange takes place approximately every few minutes. The feed alcohol vapors are passed through the bed under dehydration mode. The Adsorbent Bed will absorb moisture present in feed vapors and dehydrated product alcohol vapors are obtained from bottom of the bed.

The product alcohol vapors are then passed through Regeneration Preheater and Feed Preheater for heat recovery. The Product alcohol vapors are then passed through Product Condenser where product vapors are condensed with the help of cooling water. Condensed product alcohol is collected in product receiver. The Product alcohol from Product Receiver is pumped to Product Cooler where it is cooled with the help of cooling water and then sent for anhydrous alcohol storage.

During regeneration mode, vacuum is applied through vacuum pump or Eductor to the bed under regeneration. A small amount of product alcohol vapors are purged through the bed in regeneration mode under high vacuum, to prepare the desiccant for cycle changeover when this bed goes online.

The purged alcohol vapors act as carrier for removal of moisture from the bed. These alcohol vapors along with moisture c\re obtained from bed. These alcohol-water vapors (regeneration stream) are condensed in Regeneration Condenser.

Vacuum is pulled in the system with the help of Vacuum pump/ Ejector; Regeneration stream is used as motive fluid for Vacuum Ejector. The regeneration stream coming from the Regeneration Condenser is pumped, preheated in Regeneration Preheater and fed to the Evaporator Column for recovery of alcohol. Moisture present in feed alcohol is removed from the bottom of the Evaporator Column in the form of spent lees.

After one cycle is over, the beds are interchanged, that is, the bed on dehydration mode will be switch over to regeneration mode and the bed on regeneration mode will be switch over to dehydration mode, with the help of automation system.

Dehydration System-

Energy efficient process with a steam consumption of not more than 0.6 kg/liter of RS feed.

The plant shall be fully automated, virtually eliminating human error. The plant can suitably be operated up to 60 % turndown.

TECHNICAL SPECIFICATION FOR ETHANOL PLANT

Sr. No.	Particulars	Diameter Min. (mm)	M.O.C.	No & Type of Trays	Thk. Shell/Plate/ Down-Comer (mm)	Qty.	Remark
A.	**COLUMN & MOLECULAR SIEVE BEDS**						
1.	Evaporation Column	To be Specified	SS-304	35 (Min) Sieve	4/2.5/2.5	1 No.	
2.	Molecular Sieve Beds	To be Specified	SS-304	-	Min 4 mm	2 Nos.	
3.	Molecular Sieve Beads	-	Silica Beeds	-		Suitable	Make - Zeochem
4.	Support Balls 25 & 10 mm	-	Ceramic	-	-	Suitable	

Note:

1. Specify quantity of Molecular Sieve and ceramic supports ball used for each Bed in Kg.
2. Molecular Sieve Beads should be of ZEOCHEM make only.

Sr. No.	Particulars	H.T.A. Min. (M^2)	M.O.C. Shell and Tube	Tube OD/ Tube Thk. / (mm)/ Length (m)	Shell Thk. (mm)	Qty (no)
B.	**REBOILER/CONDENSERS**					
1.	Evaporation column Reboiler	To be specified	Tube SS-316 Shell 304	25.4/1.6/3	3	1
2.	Super heater	To be specified	SS-304	25.4/1.2 /3	4	1
3.	Regeneration condenser	To be specified	SS-304	25.4/1.2/3	3	1
4.	Rectified Spirit feed pre heater	To be specified	SS-304	25.4/1.2/3	3	1
5.	Product condenser	To be specified	SS-304	25.4/1.2/3	3	1
6.	Evaporation column condenser	To be specified	SS 304	25.4/1.2/3	3	1
7.	Product cooler	To be specified	SS-304	25.4/1.2/3	3	1
8.	Regeneration cooler (PHE)	To be specified	Frame- MS and Plate- SS-304	-	-	1

Note:

1. Re-boilers condensers are provided with bonnet in SS 304 at both end. Drain valve should be provided.
2. Condensers to be provided with front/rear water header, necessary reflux flow glass housing, degasifying bottles mentioning the position i.e. horizontal/vertical & necessary connections etc.
3. Flanges should be provided at every 12 meters in the piping.
4. For Reboilers tubes SS-316, 1.6 mm thick & for condenser tubes SS-304, 1.2 mm thick.

Sr. No.	Particulars	Capacity	M.O.C.	Thk. (mm)	Qty. (no)
C.	**MISCELLANEOUS**				
1.	RS Day Feed Tank	35 m3	MS	6/6/5	1
2.	Product Receiving tank	0.5 m3	SS-304	3	1
3.	Regeneration Receiver tank	1.5 m3	SS-304	3	1
4.	Vacuum drum	0.5 m3	SS-304	3	1
5.	R.S. feed filter	--	SS-304	--	1+1
6.	Product filter	--	SS-304	--	1+1

Sr. No.	Particulars	M.O.C.	Class	Remark
D.	**PIPING FITTINGS AND VALVES**			
1.	Piping a. Rectified spirit b. Water c. Steam d. Alcohol e. Spent less	 SS-304 MS MS SS-304 SS-304	 -- C-Class IBR -- --	Steam piping Non IBR and IBR as applicable. For SS-304 Piping- Sch. 10 shall be provided for all sizes
2.	Valves- a. Rectified spirit b. Water c. Steam d. Ethanol e. Spent less	 SS-304 CS CS SS-304 SS-304	 -- -- -- -- --	To be specified

Note: 1. All flanges should be as per ASME/ANSI B 16.5.
2. All ball valves should be full port type only.
3. For piping every 6M distance flanges should be provided

Sr. No.	PARTICULARS	M.O.C.	Capacity	Head	HP/KW	Qty (No.)
E.	**PUMPS & MOTORS**					
1.	Rectified spirit feed pump	SS-304	2 m3/hr	55	To be specified	1+1
2.	Regeneration circulation pump	SS-304	To be specified	65	To be specified	1+1
3.	Product Pump up to receiver	SS-304	2 m3/hr	30	To be specified	1+1

Note-

- All pumps should be provided with flameproof motors with double mechanical seal.
- CIP tank installed in fermentation to be used in distillation for CIP purpose.
- Non return valve to be provided for each pump.
- Pressure gauge should be provided for each pump
- Safety guard for all the motors.
- All flanges to be confirmed to ASME/ANSI B 16.5.
- Ball valves to be full bore.
- Flanges to be provided at minimum distance of 12.0 meter piping.
- For all SS piping schedule 10.
- List of pumps is tentative and may change with distillery technology offered. Proper notes to be mentioned for any addition or deletion of pumps

3.4 SPECIFICATION FOR ELECTRICAL:

All electrical distribution system with in the distillery plant, including PCC panel, MCC panels, power & control cables, accessories, Indoor & outdoor Illumination, earthing & lightening protections, all mandatory safety devices, instrumentation, etc., will be included in the Bidder's scope.

Power supply up to PCC at 415V, 4 wire system will be fed to PCC through NPS Bus duct by other agency. From PCC onward internal distribution (internal power distribution including related panels / switch boards / starters / cables / protections will be in the scope of EPC Bidder.

3.4.1 POWER CONTROL CENTER (PCC) & MOTOR CONTROL CENTERS (MCCs)

PCC/MCCs will be made from CRCA (Cold Roiled Cold Annealed) sheet metal fabrication. MCC will be non-draw out type, compartmentalized non-flame proof type with fuse less system and located at non-flameproof area. The Panels shall be CPRI type tested.

PCC & MCC will be fabricated from 14/16-gauge MS CRCA sheet, floor mounted, suitable for indoor installation, vermin/dust proof, weatherproof with IP52 degree of protection. Cable entry shall be from the bottom as a standard feature. Top cable entry may be provided, if required as per layout requirements.

A. PCC shall have following feeder arrangements,

- **Incoming feeder** :
  - 415V, 3200A, TPN MDO/ EDO, ACB with microprocessor based OC, SC & EF protection
  - Emergency DG Power Feeder with cabling for Emergency power supply from DG set panel (DG set & Panel in Incineration Cogen Bidder scope).
  - Restricted Earth Fault Protection Relay
  - Under Voltage & Over Voltage protection relay
  - ACB ON, OFF, Trip indications
  - R,Y,B supply indications
  - Ammeter with selector Switch
  - Voltmeter with Selector Switch
  - Multi-function meter with RS 485 port

- **Outgoing feeders** :
  - 415V, TPN MDO ACB (above 800A rating) / fix type MCCB (Up to 630A rating) with microprocessor based OC,SC & EF protection
  - ON, OFF, Trip indications
  - Ammeter with selector Switch
  - Multi-function meter with RS 485 port

B. PCC shall have following feeder arrangements,

- **Incoming feeder** :
  - One main Incomer and One DG supply Feeder
  - 415V, TPN MDO/ EDO ACB (above 800A rating) / fix type MCCB (Up to 630A rating) with microprocessor based OC,SC & EF protection
  - ON, OFF, Trip indications
  - Ammeter with selector Switch
  - Voltmeter with selector switch

- **Outgoing DOL Starter feeder up to 22KW** :
  - MPCB with microprocessor based OC & SC protection
  - ON, OFF, Trip indications
  - Ammeter
  - Contactor min. 1 size higher than type 2 coordination.

- **Outgoing Star Delta Starter feeder above 26KW** :
  - MCCB with microprocessor based OC & SC protection
  - ON, OFF, Trip indications
  - Ammeter with selector Switch
  - Contactors min. 1 size higher than type 2 coordination.
  - Star Delta timer

- The panels shall be manufactured with following criteria,
  - All Bus bars shall be Air insulated and of ALUMINIUM. Bus bar size shall be selected based on Temperature limit of 85 °C at Bus bar for the rated current. Max. Current density of bus bar shall not be more than 0.7 A /sq. mm. for PCC & 0.8 A / sq. mm. for MCCs. All bus bars shall be provided with heat shrinkable sleeves of Full Voltage rating. with insulation shrouds at joints.
  - Length of MCC shall be limited to 10M.
  - Maximum operating load on MCC shall be limited to 500KW.
  - Squirrel Cage Motors up to 22 KW shall have automatic DOL Starter suitable for operating from MCC, DCS and PB Station near Motors.

- Motor rating above 26 KW up to 160 KW shall be with Automatic Star Delta -Starter suitable for operating from MCC, DCS and PB Station near Motors.
- In PCC and MCC there shall be min. One spare feeder for each rating.
- VFD shall be provided as per the functional requirement. Local / Remote speed control to be provided
- MCC shall be floor mounted self-supporting, dust and vermin proof, fixed type construction.
- Rating of Switchboard incomer ACB/SDF shall be 1.2 times the operating load current.
- Push Button Station with Shrouded type actuator for ON push button, Lockable Mushroom type actuator for OFF Push button with Aluminum die cast enclosure shall be provided. Push Button Station for Motors above 22KW rating shall be provided with suppressed scale Ammeter. Push Button Station for VFD shall have Speed Setting Potentiometer and speed indicator in addition to Push Buttons and Ammeter.

❖ All routine tests shall be carried out on the panel in presence of purchaser or his representative. These tests shall include following:

a. Verification of components ratings and operation.
b. High voltage measurement test.
c. Insulation Resistance measurement.
d. Control testing.

❖ Approval on following drawings shall be obtained before manufacturing the panels

a. General arrangement drawing.
b. Wiring Diagram.
c. Detail bill of material.
d. Type test certificate

3.4.2 POWER FACTOR IMPROVEMENT

- Plant PF shall be required to improve above 0.98

  ❖ This is achieved by providing :

  APP Capacitor Banks at MCCs and Provide Automatic Power Correction Panel with required no. of APP type capacitor banks in 415V PCC. Fixed type capacitors shall be connected near MCC with appropriate capacitor duty contactor and FSU feeder in MCC.
  To determine number of capacitors following consideration be given,

- Operating KW & Average operating P.F. to be maintained
- Drive with VFD shall maintain P.F. above 0.95. These loads shall not to be considered for deciding capacitor rating.

3.4.3 POWER CONTROL CABLES

Electrical to interconnect equipment in Bidder scope within specified battery limits, comprising XLPE insulated, PVC sheathed, Copper conductor cables up to 6 sq. mm. and Aluminum conductor cables above 6 sq. mm. for power and armored copper conductor control cables shall be provided. Necessary FRP ladder / perforated cable trays shall be provided. Necessary built up cable trenches wherever required shall be provided by Bidder.

❖ All cables shall be 1.1KV grade PVC/ XLPE insulated.

a. The cable sizing calculations shall be submitted by Bidder as per the fault level of system. The cable sizing shall be done with 50KA fault current for the duration of 0.1 sec.
b. The necessary derating factors as recommended by manufacturers shall be considered while deciding the cable size. These shall be mainly comprising of,

- Derating for temperature,
- Derating for depth of laying,
- Grouping factor,

c. The instructions given for erection of the cables shall be followed as per manufacturer's recommendations.

3.4.4 ILLUMINATION SYSTEM

The illumination system shall be flame proof and consist of complete Lighting panels, lighting fixtures, cables, junction boxes cables etc.

a. The illumination system shall be provided as per the recommended lux levels and good engineering practices followed in industry today.
Following lighting sources are considered,
Process area – Industrial LED type High Bay / Mid bay
Industrial type LED batten fitting
Panel Room – Industrial type LED batten fitting
Control Room – LED fixture with Mirror reflector

Outdoor Lighting – LED Well Glass in process equipment areas &
LED Flood Light fixtures for peripheral lighting.

b. Following lux levels are recommended,
Control room - 300 Lux
Process areas - 150 Lux.
Outdoor areas - 50 Lux.

c. The illumination system shall be comprising of following main equipment,
- Main Lighting Panel
- Lighting MCB DB.
- Lighting Fixtures with junction box
- Cabling / point wiring

3.4.5 EARTHING & LIGHTENING PROTECTION SYSTEM :

The measurement of soil resistivity shall be done by Bidder after award of the assignment. For design purpose, the soil resistivity value of 100 Ω meter shall presently be considered.

The earthing shall have following specifications:

a. The entire earthing installation shall confirm to IS 3043.
b. Earthing electrode shall be CI Pipe type.

c. The earthing electrode shall be 100 mm diameter 3M long C.I. pipe buried under ground up to the level of 2.5 mtrs.
d. Earthing terminal shall be complete with watering pipe, funnel screen & earthing bus bars.
e. Earthing pipe buried under ground shall be surrounded by 300 mm thick homogeneous layer of charcoal and salt.
f. Earthing chambers shall be provided with CI covers of size 450mm x 450 mm or with circular cover having 600 mm dia.
g. All the material required for the earthing system shall be supplied and installed by the Bidder. The main grid conductor shall be hot dip G.I. strips of 75 mm x 10 mm size.
h. All the material required for making earthing stations/ pit like plate, charcoal, salt etc. shall be supplied by the Bidder. Excavation and refilling for laying of earth strip and for earth pit shall also be in Bidder's scope.
i. The entire earthing installation shall be done in accordance with IS specifications and standard engineering practices.
j. The entire earthing system shall fully comply with Indian electricity act and rules, The Bidder shall carryout any changes desired by the electrical inspector & state electricity board authorities in order to make the installation conforming to I.E. rules. The EI & KSEB will be final authority for the system which Bidder will have to follow & execute in his scope.
k. The locations of earth conductors, earth electrodes, earthing points of equipment's shall be determined by the Bidder in consultation with Engineer in charge at site. Any changes in the methods, routing, size of conductor etc. shall be subject to the approval of engineer in charge.
l. The excavation and refilling of earth necessary for laying underground earth conductor and for earth electrode shall be in Bidder**'s** scope. There will not be a separate agency employed by purchaser for this purpose.
m. The main earth grid shall be laid at a depth of 600 mm below Ground level. In case of built in trenches, earth strip shall be laid along the trench and shall be firmly cleated to the wall or cable supports. It shall be protected against mechanical damage. Joints and tapping in the main earth grid shall be made in such a way that reliable and good electrical connections are permanently ensured. All joints below grade level shall be welded and suitably protected by giving two coats of bitumen and covering with tar tape.

n. When the earthing strips are joined together minimum overlap of 100 mm shall be provided. To have better joint, the overlapped portion shall be properly welded and covered with tar tape
o. Conduits in which cables have been installed shall be earthed bonded and earthed. Cable amour shall be earthed at both ends by providing GI/ copper clamp and PVC wire of suitable size near each cable gland.
p. The electrodes shall be tested for earth resistance by means of standard earth tester.
q. A disconnecting facility shall be provided for individual earth pit to check earth resistance.
r. Earthing system includes provision of earthing to distillery equipment, structures, panels etc. with suitable earthing conductor.
s. All paint, scale and enamel shall be removed before earthing connection are made.
t. Anchor bolts or fixing bolts shall not be used for earthing connections.
u. Entire earthing system and lighting protection system shall be tested for continuity by earth testing equipment after completion of the installation.
v. Earth resistance value shall be checked and verified. If it is high then corrective measures such as addition of earth pit shall be taken to obtain desired value.
w. The record of earth resistance and test results shall be maintained for future reference.

3.5 DCS BASED INSTRUMENTATION & CONTROL SYSTEM

1. The entire Distillery plant will be complete with the basic instrumentation and control system, necessary for its safe and efficient operation and will be in the Bidder's scope.
2. The control system shall be based on the State-Of-The-Art Distributed Control System (DCS) technology, with Data Acquisition and control of the key operational parameters.
3. Instrumentation shall be complete in every respect and liberal to the extent of providing data on all operation variables sufficient for the safe efficient, easy operation, startup shut down of the plant.
4. All instrument and equipment shall be suitable for use in hot, humid and Tropical industrial climate in which corrosive gases and / or chemicals may be present. As a minimum, all instruments and enclosures in field shall be dust proof, weather proof as per NEMA 4 (IP:55) and secure against the ingress of flue gas, dampness and vermin.

   All external surfaces shall be suitable treated to provide anti-corrosion protection.
5. Location of tap of connection shall be either from the side or from the top of the equipment but not from the bottom. This requirement is applicable to both pipes and vessels. The location of lower side connection shall be high enough to prevent plugging due to dirt or other suspended solids in addition, the connection shall be short, vertical or horizontal and without pockets.
6. Material of construction of instrument shall be consistent with temperature, pressure, corrosion condition and other process requirement.
7. Ranges for instruments shall be selected, in general, such that in normal process operation is between 40% and 60% of span for linear and from 60% to 90% of span for square root.
8. The complete instrument system shall be designed for safe operation, using normally closed contacts which open on fault condition.
9. Adequate alarms shall be provided to give audible and visual warning of malfunctions. The Bidder shall also provide alarm contacts for the operation of parallel alarms, common pre-alarm and shut down alarm by the purchaser wherever indicated.

10. Gauge glasses shall be provided for all level measurements requiring automatic or manual control or monitoring. They shall have at least the same pressure and temperature rating as that of equipment on which they are to be installed. They shall have ball check auto shut off valves suitable for the required temperature.
11. Isolation and bypass valves shall be installed with all control valves. Hand wheels and air lock valves shall be considered for all control valves.
12. Control valves sizing formula shall, in general, be as per ISA-75, 07. Control valves shall be sized for the available pressure drop at normal flow and shall permit up to 125% of the maximum flow. The Bidder shall submit the sizing calculation for all control valves. DP shut off shall be 10% more than upstream pressure for actuator sizing.
13. Orifice plate calculations shall in general, follow BS 1042. Orifice diameters shall be selected so that d/D ratio is between 0.2 to 0.7 for gases and up to 0.75 for liquids. Bidder shall submit the sizing calculations for orifice plates.
14. All transmitters shall be provided with output meter / output gauge at the transmitter end. All transmitters shall be smart type.
15. The Bidder shall ensure that the packing of instruments and associated equipment is adequate to prevent damage from such contingencies as rough handling, weather, condensation, dew, vermin and vibrations.
16. All Solenoid valves shall be universal type and continuous rated type.
17. Comprehensive instrumentation and control equipment will be provided for each major areas i.e Distillation, Fermentation, Evaporation, Electrical system and Balance of Plant including data transfer of major parameters with incineration boiler & its cogen Plant.
18. The Centralized control / monitoring shall be from a Remote Central Control Room, where the DCS and its sub systems including the operator console, shall be located.
19. **DCS Hookup:** From incineration boiler / Cogen Plant DCS with required software & compatibility with internet so as to transfer daily / shift wise MIS to Management / Senior officers of Plant.

The key instrumentation and control system shall be as follows:

3.5.1 For Main Plant and its auxiliaries

A. The control of the Plant like operation / start-up / shut down / trip, shall be realized directly from the DCS. All the signals required for controlling the operation shall be processed by the DCS and necessary actuating signals for the various final control elements shall be driven from the DCS.

B. The major control includes the following, as a minimum:

   i. Level control
   ii. Pressure Control
   iii. Flow Control
   iv. Temperature Control

   Signals from the following shall be taken to the DCS for monitoring / interlocking purpose.

   i. Feed pumps and transfer pumps
   ii. Dosing Systems
   iii. Plant safety and protection interlocks

C. The instrument air compressor shall be controlled by their individual dedicated system. This system shall be interfaced with the DCS through serial communication for monitoring and data acquisition purpose. The instrument air should be dry.

D. Various electrical inputs from the transducers and the digital signals from MCC panels shall be processed in the DCS system for achieving the necessary interlocks / controls.

E. The PRDS functions shall be directly processed by the DCS.

F. The design of the total control system will be such that the following sub system functions will be handled by the respective equipment:

   i. Data acquisition, display and logging sub system for monitoring, display, logging and printing of process parameters like flow, temperature, pressure, level, power, current, voltage, analytical and status will be performed by the operator station.

   ii. Start / Stop Sequence & Interlock sub systems consisting of the safety interlocks, Sequence of starting and stopping of the power plant and alarm generation will be achieved by a redundant DCS system.

iii. Closed loop control sub system consisting of the continuous monitoring of the operational parameters like Level, Pressure, Flow etc. and controlling of the same using the PID functions will be achieved by DCS system.

iv. Engineer / Operator Interface sub system consisting of setting / changing the operational parameters based on the experience of the operator and as a reaction to emergency situations will be achieved by the computers used as the operator station.

v. Communication sub system for interconnecting all the above systems.

vi. Data highway and network for connecting the control and data acquisition sub systems, operator interface sub systems to a duplexed data highway such that there will be information exchange among each one of them.

vii. Auxiliary units such as system cabinets, printer consoles, marshaling cabinets and power supply distribution cabinets.

G. The Distributed Control System is proposed for control and instrumentation system, keeping in view the safety, reliability and availability for comprehensive presentation of plant operation status, trends and essential operator interaction facility.

The DCS based plant control will have the following inherent advantages:

i. Integration of information from different individual controls provides centralized data on plant operation.
ii. Increased reliability due to the use of Large Scale Integrated (LSI) components.
iii. Increased flexibility for modification at any stage due to software configuration capability.
iv. Better availability due to provision of critical module redundancy coupled with Auto / Manual stations.
v. Modular design concept provides easy expandability for future in hardware and software.
vi. Higher maintainability due to improved self-diagnostic and display features.

H. The major design aspects of the system will be as follows:

i. Control will be of the type which normally relieves the operator of continual regulating duties and will be backed up by interlocks and safety systems that will take pre-planned action in cases where unsafe trends and / or conditions develop faster than the operator's ability to respond.

ii. Continuous self-checking features shall be incorporated in system design with automatic transfer to healthy / redundant circuits to enhance the reliability of the complete system.

iii. All the closed loop analog signals shall be processed by the DCS. All the safety and interlock signals and digital signals shall also be processed.

iv. Redundancy will be provided in the Central Processing unit, power supply (both at the CPU & I/O), I/O modules and communication modules (both between the controller and the operator station and between the I/O modules and the controller).

v. Redundancy will also be provided for the communication cables.

vi. Power supply used for interrogation with field devices shall also be redundant.

vii. The DCS shall be provided with processor, power supply, communication and critical I/O redundancy for the entire system.

viii. The Input / Output modules will be provided with noise filter and galvanic / up to isolation from external control source.

ix. The Input / Outputs modules will also be provided with protection against reversal of polarity of supply voltage

x. The inputs modules shall be suitable for processing the field signals. The outputs will be short circuit proof and protected by fuses.

xi. The memory will be nonvolatile or battery backed up as required.

xii. The programming language shall be based on logic statements / functional blocks.

xiii. On line replacement of modules shall be possible without affecting the process (Hot swappable).

xiv. Auto boot up facility for the DCS shall be within 2 minutes.

xv. Display response time shall be less than 2 sec.

xvi. Data communication network response time shall be less than 100 m Sec.

xvii. Closed loop control task execution (control response time) shall be done within 250 m Sec.

xviii. Sequence control / Interlocks scan time should be within 100 m sec.

xix. Display update time shall be less than 1 sec.

xx. The system shall be designed so that the failure of any monitoring device or control components or spurious intermediate grounding in the signal path shall not open the signal loop nor cause the loss or malfunction of signal to other devices using the same signal.

xxi. All equipment / systems located in the field shall be suitable for continuous operation without loss of function, departure from the specific function or damage at the ambient temperature and humidity conditions.

xxii. The control system software shall have all the essential capabilities to perform advanced control algorithms as a minimum. It shall be user friendly, easily programmable and have excellent data acquisition, graphic display and logging capabilities.

The field instruments that are primarily responsible for measuring the process parameters will be having the following major design features:

i. All the field instruments / equipment that are used shall be of the same make for ensuring the smooth and optimal maintenance including efficient spare parts management.

ii. All field instruments used for sensing transmission and measuring shall be of electronic smart type with signal transmission in current mode of 4-20 mA.

iii. All control valves and control damper drives will be of pneumatic type because of their fast response and ease of maintenance.

iv. Appropriate de-rating of electronic components and parts.

v. All the instruments shall have communication facility thro RS 485 interface.

vi. Important plant parameters, that are required to assess the plant efficiency, must be serially communicated to the operator station for the purpose of display / logging.

vii. All solid state systems / equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the specification requirements of surge protection.

viii. All solid state electronic system / equipment furnished shall meet the requirements of Burn-in and Elevated temperature test.

ix. All the instrumentation cables shall be flame retardant low smoke type.

x. The instrumentation cables and wires shall function without breakdown for surges experienced in the control system. Voltage class and insulation level shall be compatible with the signals they convey.

Apart from the above integrated control system, local gauges will be provided near the equipment / pipelines at essential parts of the plant for the purpose of operator guidance.

Scope Of Supply

a. Design, system & software engineering, manufacture, supply of hardware & licensed software, testing, inspection, Factory Acceptance Test (FAT) packing, forwarding, transportation, Site Acceptance Test (SAT), erection & commissioning, post commissioning assistance till plant stabilisation.

b. The integration of all the inputs / signals for continuous monitoring, operation, data logging, data analysis, alarms, safety interlocks, annunciations etc. will be achieved through the DCS.

c. The DCS will include the DCS control station, related licensed software & hardware, instrument & control cabling from the marshalling cabinet receiving signals from junction boxes of all equipment, all MCC's and software links wherever essential.

d. The scope includes training at OEM's Centre, documentation, establishing communication between operating station and DCS and any other item, which is necessary for smooth operation of the system.

e. Bidder to carry out engineering of system hardware and software to meet functional requirement outlined elsewhere. However, the system shall be freely expandable to reasonably high level, by adding hardware and related software without in any way, compromising the system capability with respect to system communication and memory to handle additional software.

f. The entire Distillery plant will be smoothly started, normally operated, provided with necessary interlocks & emergency trips, monitored, controlled and smooth shut down from the DCS.

g. Bidder to provide the DCS with required software & compatibility with internet so as to transfer daily / shift wise MIS to Management / Senior officers of Plant

General Specifications for DCS

Distributed Control system shall be provided for the safe and efficient monitoring & operation of Distillery plant in all regimes of operation.

The system shall be microprocessor based having functional distribution and data base distribution sub-system wise.

a) Digital Inputs

Digital inputs shall be potential free. The inputs to the DCS shall be contact closures, closed during process normal conditions. Contact interrogation voltage shall be 24 V DC.

Loop current : to be informed by Bidder
Galvanic / optical isolation : required for input channels
Max. Number of inputs per card: 32 nos.

b) Dynamic colour graphic displays

i. All the process parameters, variables shall be displayed dynamically on graphic displays. Process data shall be visible on this screen with its equipment. Equipment shall be displayed in standard ISA symbols.

ii. Normal operation & control of the process shall be possible using numerical keypads and functional keys on the console by monitoring the same on the screens.

iii. The OS should perform all the normal plant operation, control & monitoring functions. It should be possible to select displays either through keyboard or mouse. Display should be updated at least once in one second.

iv. Hyperlinks (Navigation buttons) shall be configured for navigating from one page to the other for a particular service.

c) Alarm:

Alarms shall be software configurable and shall be divided under following two categories

1. Process alarms : First out
2. Process alarms : Normal
3. Hardware & diagnostic alarms with error codes and description

Alarms shall be displayed on the console screen at the time of its occurrence. The same shall appear in the first out sequence.

Alarms shall occur on the screen with its tag / description / process data.

Critical alarms should have time stamping in milliseconds. The same shall be also printed on the printer. Bidder shall add alarm text. ISA sequence shall be followed for alarms.

d) Push Buttons and Selector Switches:

Shall be software configurable on the screen which includes following:

1. Momentary NO & NC push buttons
2. Latched push buttons
3. Two or three way position selector switches

e) Bar Graphs:

Bar graphs shall show the dynamic value of process parameters, which will correspond to numeric value in Engineering. Unit. This shall also be displayed in percentage value, engineering units. Bar graph for PID controller includes process variable, set point, remote SP, manipulated variable (MV) in different colours. Status of loop i.e. auto / manual / cascade shall be displayed alphabetically and with colour change.

f) Controller faceplate / Switch face plate:

Controller faceplate shall include numeric Engineering. Unit display and Bar graph for process variable, set point & manipulated value. Auto / manual / cascade operation shall be possible. Set point change & manual operation shall be possible from this faceplate. Manual to auto changeover & vice versa shall be bump less. Changeover from local set point also shall be bump less. PV / SP tracking in PID controller shall be possible.

Switch face plate shall include ON / OFF switches including start / stop PBs. Operation of start / stop push buttons / selector switches shall be possible from this faceplate. Feedback of start / stop operation shall also be displayed on this faceplate.

g) Tuning Display:

This display shall be useful for tuning of PID controller. This shall include controller faceplate. P, I, D values shall be accessible from this screen and can be changed only by engineer with password facility. Trending display to be configured for tuning controllers.

h) Totalizer:

Totalizer shall display the numeric totalised values of flow parameters. Reset facility for totalizer shall be available from same display screen with password or engineer login. It should be possible to change the totalizer constant from the faceplate. (These features shall have password lock facility)

All DO's shall be converted to plug in relays. Relay contacts shall be wired up to the terminals (1 fused terminal per output).

24 V power supply to digital input interrogation and analog transmitter power shall be provided. All phase supplies shall be of SMPS type of Phoenix / Mean well.

The system shall be able to operate satisfactorily up to ≤ 50 Deg. and 10% to 90% non-condensing humidity.

Modular system shall be adopted to facilitate easy system expansion. The type of modules shall be kept minimum possible in order to have inter-changeability and low inventory.

On-line replacement of any module shall be possible in such way that removal and addition of module shall be possible without switching off the power supply. Furthermore, there should not be any interruption of the system while replacing a faulty module wherever redundant modules are provided.

The system design shall ensure that no single failure in system results in any loss in system operation.

The system shall provide safe operation under all plant disturbances.

Galvanic / Optical isolation shall be provided for all field signals. Isolation shall also be provided between operator / engineering station and controller subsystem.

The system software shall be governed by the operation system running in a real time mode and shall be to meet all functional requirements specified elsewhere as a minimum.

i) Software

(i) The configuration software for the DCS shall be in the functional flow diagram or ladder. Programs shall be protected from accidental changes by use of password. Development mode of MMI software to be provided for graphics modification.

(ii) MMI Software to be loaded on a PC, i.e. operating station. There will be common PC operating cum engineering station. Engineering changes shall be password – protected. Bidder to provide configuration details of PC.

(iii) Both run time and development software to be included. Necessary tags to permit future developments to be included in H.M.I.

(iv) Only permanent license software to be provided

(v) Bidder to note that all testing / checking / configuration of DCS will be carried out from a PC. The alarm registration time stamping shall be done at CPU level, Bidder to inform the resolution time.

(vi) The system shall be capable of adapting to program changes without affecting the hardware and plant operation. It shall be possible to make logic changes and MMI changes on line without affecting control operation.

(vii) For the programming / configuration of DCS, the operating station itself shall be used. Necessary hardware & software to carry out configuration, testing, debugging, editing of both DCS & MMI Software shall be supplied and loaded in the OS.

(viii) Self-diagnostics should be in the form of error codes to indicate the type of error encountered by processor and other hardware. The various error messages with text shall be displayed on the operating station. The diagnostic features shall be programmed such that the error messages will appear on the operating station along with the text and can be acknowledged and cleared, whatever additional programming needs to be done for this shall be in Bidder's scope.

(ix) The system shall have self-surveillance, monitoring and diagnostic facility so that failure / malfunction can be diagnosed automatically to the level of individual channels of module level.

(x) The system shall be internally protected against system errors and hardware damage resulting from Electrical transients on power wiring Electrical transients on signal wiring and connecting and disconnecting devices or removing and inserting PCBs in the system.

(xi) The system shall be capable of accepting various signal inputs for its direct use while preventing noise errors due to electromagnetic interface or radio frequency.

j) CPU

The CPU shall be Redundant and shall be provided with sufficient memory for the initial configuration plus 30% additional memory for future expansion. DCS should have adequate memory with EEPROM back-up and real time clock feature.

CPU shall retain its memory in the event of a power failure, with provision of battery backup, EEPROM and RAM

The DCS should be capable of freely mixing analog & sequence logic, executing user defined functions not included in standard functional blocks, storing control configuration in on-board non-volatile memory and providing an alarm indication for back-up battery low voltage, on-line tuning of PID control loops and other parameters. System shall be provided with protection against overload current and line voltage spikes.

Scan rate for the close loop/open loop on full load shall be 250msec (max)

The CPU shall be capable of executing the following control functions as a minimum

(i) Filtering
(ii) Linearization including sq. root extraction for flow signal
(iii) Alarms, limits, checking switches
(iv) Integrating & totalisation
(v) Ratio / bias
(vi) Mid value selection
(vii) Transmitter failure detection
(viii) Function curve systems
(ix) PID loops, PID action and values shall be settable from OS
(x) Auto manual bump less transfer
(xi) Output reversal block.
(xii) Range suppression for analog inputs

(xiii) Set point ramp up / down function
(xiv) Manipulated variable ramp up / down function
(xv) AND / OR / NOT and other logic gates / Time delays / Counters / Latches
(xvi) Diagnostics
(xvii) Feed forward control
(xviii) Mathematical functions
(xix) Alarm / acknowledge / reset function
(xx) Auto / manual stations
(xxi) Manual loader
(xxii) Bump-less switch over should take place from single element mode to three element mode and vice versa.
(xxiii) An alarm output shall be generated to announce the failure of any critical component such as DCS, power supply, I/O module, communications, etc. on the operating terminal.

k) The capacity of the DCS system should be such that even after considering the space for future expansion, the loading should be lesser than 70% to permit required response time during peak loading. Free memory to be minimum 30%

Other specifications for Distributed Control System (DCS):

1.	Processor redundancy	Required
2.	Communication redundancy between processor & HMI	Required
3.	Power supply redundancy	Required
4.	Time for backup processor to take over	Less than one scan cycle
5.	Memory utilisation of its capacity	60% max.
6.	Online configuration	Required
7.	Galvanic isolation for power supply	Required
8.	Optic isolation for Input / Output signals	Required
9.	No. of points per analogue input module	≤ 32
10.	No. of points per analogue output module	≤ 32
11.	No. of inputs per digital input module	≤ 32
12.	No. of outputs per digital output module	≤ 32
13.	Installed spare I/Os	20%
14.	Spare module space in racks	25%
15.	Spare capacity for system memory & user memory	30% minimum
16.	Future expansion capability	25%
17.	All spare points in I/O modules wire up to the marshalling cabinet	Required
18.	Commissioning spares and consumables	Required

Spare

Installed spare of 20% shall be provided for each type of the modules.

The controller and data acquisition racks shall have 25% usable spare space for installing additional I/O modules in future. In addition internal wiring for the same shall be completed up to I/O Terminal.

Other details

Location: Central control room (CCR)

i. Monitoring of process parameters, equipment running status, motorised valves' open / close positions
ii. Open loop controls viz. opening and closing of dampers, control valves, motorized valves, speed setting of variable speed drives in manual mode
iii. Closed loop controls
iv. Alarms: Process alarms viz. level high, pressure low etc. and overload / trip alarms of drives
v. Operation: Start / stop drives, opening and closing of motorised valves. The operation from CCR shall be with safety interlocks, which shall be executed in respective panels or DCS from where the operation is carried.

Miscellaneous Items

Some special precautions to be taken by panel manufacturer during panel manufacture are as follows:

1. Terminal lugs shall be crimpable, insulated sleeve type for terminating external wires in the panel.
2. Sockets for powering external instruments shall be supplied / mounted by Bidder
3. Shrouding shall be provided for all terminals other than low voltage level instrument wiring
4. MCBs / Switches to have service and switch nos. punched on tags, duly installed on MCBs.
5. Instrument wires (for termination at site, if any) shall be terminated on plastic strip for easy identification at site.
6. 10% spare contactors and 25% spare terminals shall be given on each terminal strip
7. Terminals and wires for power incoming and distribution will be suitably sized.
8. Mounting arrangement to be provided for Back of panel instruments

9. Door limit switch should be covered.
10. Some field instruments shall be powered from control panel.

DCS shall have following features:

(i) Alpha numeric and bar graph display of process parameter values
(ii) Running status indication of drives on graphics
(iii) Safety interlocks
(iv) Close loop controls
(v) Open loop controls
(vi) Controller facia with indication of PV, SP, MV, A/M status, P, I, D values
(vii) Setting of SP, manual loading, tuning of P, I, D constants
(viii) Trend
(ix) Alarm logging
(x) Shift reports

Controller And Data Acquisition Sub-System

Controller and data acquisition subsystem is the main field interface subsystem and is capable of performing control and data acquisition functions either as one integrated subsystem or separate subsystem for each of these functions.

Controller sub-system

The control function of the system shall be executed by microprocessor based Controllers consisting of power supply modules, communication modules and I/O modules and a set of algorithms which are easily fields configurable using user friendly software.

The hardware capability of the controller shall primarily be exploited for regulatory control functions only. However, the sequencing and interlocking capability shall also be used.

Controllers shall be able to scan close loop in less than 200 milliseconds

Controllers shall be capable of accepting process signals from various field junction boxes, control panels and MCC's without any additional conditioning equipment.

The controller shall be capable of processing linear and non-linear analog inputs, providing square root extraction for flow signals, linearization and compensation for thermocouple. The controllers shall be able to generate 4-20 mA DC current signals for analog outputs and potential free contacts for the discrete outputs as minimum.

Loop integrity shall be maintained in controller sub-system architecture by providing one to one controller backup. In case failure is detected in the active controller all the loops of the failed controller shall have automatic control transfer switching, which shall transfer the entire configuration and data base of failed controller to the backup controller.

Design must ensure that data integrity is maintained during switch over and no portion of data to be transferred is corrupted before and during switch over to the backup controller. The indication of the failed controller shall be displayed at local as well as on the central level.

Loop integrity shall be applicable to power supply modules and any other device associated with the controller sub- system.

The controllers shall be able to operate in either manual, auto and cascade mode. In cascade loops, the primary controller shall be able to track the steeping of the secondary controller is not operating in cascade mode. All controllers shall have facility for slow and fast ramping of steeping and output.

The controllers shall be provided with redundant power supply.

Data acquisition system.

Data acquisition system shall interface and multiplex analog and discrete inputs from open loops. The inputs shall include 4-20mA DC thermocouple, resistance temperature detector and discrete contracts.

The system shall be capable of processing linear and non-linear analog inputs linearization of RTD inputs, square root extraction for flow inputs.

a) <u>Analog input</u>

Modules shall accept 4–20 milliamps signal from the 2 wire field transmitters

Max. Number of inputs per card: Max.16 nos.

24 V DC power required for 2 wire transmitter powering shall be supplied from a separate redundant power pack, which will be in Bidder scope.

b) Digital Output module

The output from DCS module shall be 24 V DC, which shall be supplied from the module itself. All the outputs going to MCC / solenoid valves / lamps or any other panel shall be though interposing relays.

Type of Digital O/P	:	24 V DC Potential output
Interposing relays	:	Relay Board with Phoenix, miniature relays, coil voltage 24 V DC, with LED for ON / OFF indication on relay board, contact rating 5 Amps, 230 C AC
Output status indication	:	Required
Galvanic / optical isolation for O/P channels	:	Required
Surge withstand capability	:	IEC 255-4
On DCS failure or card failure outputs should drop to ZERO State		
Max. no. of outputs per card		32 Nos.

DCS Bidder will require to provide power supply for the solenoid coils as per their requirement.

The scan time for critical loops will be less than 50 m sec and for analog the cycle time will be less than 200 m sec.

Data acquisition system shall be provided with redundant power supply.

Each I/O shall be isolated from the external control circuit.

Each I/O shall be protected from short circuit and reverse polarity of power voltage.

Logic controller sub-system

The control functions required to implement the logic scheme shall be executed by microprocessor based logic control system, which consisting of power supply module, CPU module, memory module, communication interface module and I/O modules.

Memory shall be non-volatile. However in case volatile memory is provided, battery backup shall be provided with a minimum of 3 months lifetime to keep program storage intact. A battery drain indication shall be provided at least one week before the battery gets drained.

Redundancy shall be provided in such a way that in case of failure of the main processor, the standby shall take over automatically. The changeover shall be bump-less and the system shall be fail proof. The indication of the failed device shall be displayed at operator station

Each processor and each I/O rack shall have a separate independent power supply. Failure of one power supply shall not affect the system operation

Each I/O shall be galvanic ally isolated from external control circuit. The minimum isolation level between I/O and logic circuit shall be 1000 volts DC

Each I/O shall be protected against the reversal of polarity of the power voltage to I/O module.

Each I/O module shall have a LED per channel to indicate the status of each I/O

Input / Output modules shall be mounted by the DCS Bidder on suitable mounting rack in the panel. Replacement of I/O modules shall be possible without disconnecting field wires. It shall be possible to accommodate any type of I/O module in any sequence. All I/O modules shall have indicated LED on field side of I/O. Blank covers shall be provided for the spare I/O module slots on the I/O rack. All DCS hardware should be suitable for ambient temperature 60 °C and humidity 85%

Each input shall be provided with filters to filter out any noise in the input line and contact bouncing noise.

All inputs shall be provided with only dry contacts. All the inputs shall preferably be double ended i.e. two wires per input and not with common return for all inputs.

The interrogation voltage to the input contacts shall be powered form separate power supply.

The output from the system shall be potential free dry contacts

Each output shall be short circuit proof and protected by fuse. Visual indication of fuse blown must be provided for each module.

Controller and data acquisition system loading

The system loading for controllers and data acquisition system shall not exceed 60% or maximum 70% after considering the provided and required future space. The loading as indicated is the worst case of high system activity referred to the use of memory.

Communication System

The communication system shall be digital communication bus that provides a high speed data transfer rapidly and reliably between the operator station, process I/O devices and other devices connected to it.

Communication system shall be dual redundant, consisting of two separate communication buses and two separate communication system interfaces for each device.

The overall system performance shall not be degraded whether Communication system is 10% loaded or 100% loaded. Communication speed on the communication bus shall be sufficient to update the operator station data base one in every second.

In case of main bus failure or any communication device failure, the Transfer to the back-up device or bus shall be automatic without interrupting the system operation and without any operator's intervention. Information about the failed device/bus shall be displayed on the operator station.

It shall be possible to switch over the communication form main bus to the redundant bus manually without disturbing the system operation. It shall also be possible to connect or disconnect a device from the system without disturbing the operation.

Web Enabling Software to view & transmit data through internet is to be provided.

Operator / Engineering Interface Sub-System

a) The operator interface sub-system shall provide the centralized information to the plant operator / Engineer in the following details.

(i) Indication of all analog and digital process variables of control loops, open loops and all loop related parameters.

(ii) Manipulation of control loops including changing set point, mode, output, configuration, turning and computational constants.
(iii) Graphic displays and status indication.
(iv) Alarm displays and annunciation.
(v) Compilation of graphic displays.
(vi) Self-diagnostic messages.
(vii) Required interlocking schemes

b) The Engineering interface sub-system shall be used for configuring, tuning and maintenance of the system. It shall be possible to perform the following system configuration functions.

(i) Data base configuration including overview, group, loop, mullti-loop and Multi-variable control configuration.
(ii) Configuration or re-configuration of alarms settings, their values, addition or deletion of any control block or component in loop
(iii) Tuning of control loops like changing P.I.D., dead time values, etc.
(iv) Compilation of graphic displays.
(v) Compilation of logs/report/historical trend points.
(vi) To call detailed self-diagnostic displays for maintenance aid.

c) Each Engineering / operator station shall consist of TFT monitor and keyboard, each driven by independent electronics.
d) The stations shall be housed in the consoles.
e) Each Station shall be of industrial type and size shall be 22".
f) LCD data, display update rate shall be less than one second.
g) All the operator station shall be interchangeable. However under normal operating Condition, each operator station shall be assigned a specific area. The system shall have global database available at each operator station. Further any change made in the database of one operator station shall automatically update the database of other operator station.
h) One logging printer and one alarm & event printer shall be provided. Alternatively, each engineering / operator station will be provided with one printer for sequentially logging data and alarm & events.

i) Keyboard

Keyboard shall be self-explanatory, easy to operate and shall meet all the functions to configure, operate and maintain the system. A conversational user friendly software shall be used for operation configuration and maintenance of system.

Keyboard shall preferably be touch sensitive Industrial grade membrane type. Each keyboard entry shall be registered with an audio beep.

j) Process displays

1. Overview display

Each display shall incorporate a minimum of 120 analog or discrete inputs which can be monitored simultaneously on the LCD screen i.e. page. Each page shall be organized into a suitable number of groups. Each group shall further incorporate suitable number of inputs i.e. tags. Suitable identifications and description shall be shown for each group on the overview display to relate it to a loop display.

All analog points in the overview shall be represented as variable lengths indicating deviation above or below the normal operating value or set point.

Alarms shall be displayed in change of colour against each variable.

An input in alarm condition shall be identified by flashing. Control loops operating in manual mode shall be indicated

2. Group display

Group display shall be limited to the group of inputs as displayed in the overview display. Each group shall preferable include eight number of inputs.

Each input in the group shall be identified by the tag number, unit of measurement and process description which shall be displayed on the LCD screen.

Display, as a minimum, shall show following degree of details:

- Process variable in analog form shall show as a percentage of the transmitter span on a linear scale bar graph of 0-100% engineering units and in digital form as alphanumeric display in engineering units.
- Set point value in analog form as a percentage of the transmitter span on linear scale bar graph of 0-100% engineering units and in digital form alphanumeric display in engineering units.
- Output value in analog form as a percentage of the transmitter span on linear scale bar graph of 0-100% and digital form as percentage.
- Controller modes i.e. auto, manual & cascade.
- Process alarm on process variable, deviation or velocity
- Control valve failure position.
- The contact input/ output shall be represented by simulated graphic lamps and configurable alphanumeric status description.

It shall be possible to control the process from group view.

Following control actions shall be possible.

a. Increase/decrease of set point value either slow or fast.
b. Change of controller mode i.e Auto / manual transfer
c. Changing output to the final control element
d. For digital points start/stop or open/close command.

3. <u>Loop Display</u>

Loop display shall provide a separate detailed display for each of the process inputs. The graphic representation of analog and digital points shall similar to group display. However in addition following information shall also be presented in alphanumeric form as a minimum.

a. Controller tuning constants.
b. Process variable zero and span values.
c. Alarm set point on various parameters.
d. Limits on set point, output, velocity etc.
e. Controller action (direct/ reverse).
f. Failure position of final control element.
g. Engineering units.

It shall be possible to change the following through the keyboard of operator.

a. Changing tuning constants (restricted by password)
b. Changing scale, zero and span (restricted by password).
c. Changing limits on set point, output, velocity etc.
d. Changing configuration of any loop (restricted by password)
e. Changing alarm set points.
f. Changing control mode.
g. Changing output to the final control element.
h. To issue start/ stop or open/ close command for digital points.

Loop display shall also contain a trend displaying process variable, set point and output with sample interval time of maximum 1 second and full scale time base of minimum 60 seconds for tuning the process control loops.

4. Graphic display

It shall be possible to display dynamic graphic of different sections of the plant on the engineering station.

Graphic display shall be interactive type through which it shall be possible to control the process. It shall be possible to send motor start/ stop and shut down valve open/ close.

It shall be possible to view the process variable and alarm points and view and change steeping value, manipulated variable, controller mode etc from the graphic display.

The system shall have the capability of having and developing graphic symbol library as per ISA-5.1 and 5.3. Various colours used in the generation of graphics like colour of process lines, utility lines etc. The same shall be finalized during detailed engineering.

It shall be possible to go from any graphic page to related graphic pages or any group view or alarm summary.

5. Trend display

The system shall be capable of displaying the real time and historical trends for the parameters or variables like measured variable, set point, output, calculated variable etc.

The system shall also have a multi-trend capability in such a way that it shall be able to display set point, measured variable and output on the same display.

It shall be possible to display by scrolling or expanding the time base for all the time base for all the trends.

Historical data shall be stored on the non-volatile memory device like hard disc in such a way that such historical data can be utilized for archival storage and subsequent recall. Maximum possible period of storage shall be indicated by the Bidder.

Historical data trends shall be displayed for a minimum up to 25 hours for a data-sampling rate of 1 minute.

Alarm monitoring and display

A. Alarm management

It shall be possible to display process as well as system alarms on the operator station for operator's attention and action.

Alarm messages shall be displayed by flashing the page and group number of the input under alarm irrespective of type of display.

All alarms shall be displayed as and when they occur or generated with change in the colour of display in the following sequence, activating an audio signal.

The system shall not put off the audio alarm and visual flashing even after the condition returns to normal unless the operator acknowledges it.

B. Alarm summary display

It shall be possible to display summary of all alarms in the sequence of their occurrence and shall disappear from display only when they are acknowledged and cleared. The alarm display shall list the following for each alarm as a minimum.

a. The date and time of occurrence.
b. Tag number identification.
c. Point description.
d. Serial number of alarm in the sequence of its occurrence.
e. The system shall be able to display an alarm summary

C. Alarm history

The history of alarm conditions shall be maintained in the database for alarm history display and printed on shift wise basis. The alarm display and print out shall list the following for each alarm as minimum.

a. The data and time of occurrence.
b. Tag number identification.
c. Point description.
d. Time of acknowledgement.
e. Time of return to normal.
f. The system shall be able to display and print out the alarm history of min of 300 alarms.

D. System alarm

Any abnormal condition in sub-system or any other functional device shall be displayed as system alarm messages on the operator station irrespective of the display selected.

E. Configuration display

Configuration display shall provide a separate detailed display for each loop indicating the configuration of that loop. When control requires more than one loop, all interrelated loops shall also be displayed. The following information is required in configuration display.

a. Loop configuration giving designation of each block.
b. Control block interconnection.
c. Value of each block parameter time P.I.D, ratio, bias. Dead-time etc.

Logging function

All parameters required for logging shall be stored in memory in accordance with data base update rate. However it shall be possible to perform basic arithmetic calculations such as averaging, summing, efficiency calculations etc prior to logging.
In general log format shall be user definable. However the same shall be given at the time of detailed engineering.

Self-diagnostics

The self-diagnostic message for a sub system failure shall appear on the operator station irrespective of display selected.

The system shall have an extensive set of self-diagnostic routines which shall locate and identify the system failure at least up to module level including redundant components.

At local level, failure of a module in a sub system shall be identified by an individual display.

Failure of a subsystem shall be annunciates with the change in colour.

One display page shall be available for each subsystem on the communication subsystem.

Data storage, archival and retrieval.

Historical data shall be stored on a non-volatile memory device like hard disc which can be subsequently recalled by operator on any screen.

It shall be possible to store and retrieve this data on removable mass storage media like compact disc.

Measurement

The following parameters, in minimum, will be measured, monitored, logged, integrated, displayed and collated in the DCS.

a. Power (kWh, kVA, kVARH and other available parameters) from generator metering, power to distillery, feeder wise for PCC, MCC, etc.
b. Steam to distillery & its allied process, condensate from distillery (all steam and condensate flow transmitters to have one standby).
c. Water (flow and total) for raw water, DM water, softened water, CT make-up, etc.
d. Other required Flow measurements as per norms.
e. All other measurements required for the control loops.

Instruments

Details of field instruments have been provided in the specifications of respective equipment. The same is also summarised below:

a) All instruments and equipment shall be suitable for use in a hot, humid and tropical industrial climate in which corrosive gases and / or chemicals may be present. As a minimum, all instruments and enclosures in field shall be dust proof, weather proof to NEMA 4 (IP:55) and secure against the ingress of flue, dampness and vermin. All external surface shall be suitably treated to provide anti-corrosion protection.

b) The instruments like control valves, thermo wells, orifice flanges, level instruments etc. coming on pipes and vessels under IBR shall be certified by IBR.

c) Location of tap off connections shall be either from the side or from the top of the steam generator equipment but not from the bottom. This requirement is applicable to both pipes and vessels. The location of lower side connection shall be high enough to prevent plugging due to dirt or other suspended solids. In addition, the connections shall be short, vertical or horizontal and without any pockets.

d) Materials of construction of instruments shall be consistent with temperature, pressure, corrosion conditions and other steam generator requirements.

e) The design of control panel shall incorporate provision for expansion by installing space capacity. Each panel shall be designed to accommodate 10% minimum additional equipment including 10% spare cable/ tube entry points.

f) Instrument power circuits shall employ an isolation transformer and individually protected from fault with the help of MCB's and fuses. Power supply to the individual instrument shall be disconnect able with the help of switch and protected with the help of fuse.

g) Ranges for instruments shall be selected, in general, such that in normal process operation the indication on the indicator or chart is between 40% to 60% of span for linear and 60% to 90% of span for square root.

h) The complete instrument system shall be designed for safe operation, by using normally closed contacts which open on fault conditions.

i) Adequate alarms shall be provided to give audible and visual warning of malfunction. The Bidder shall also provide alarm contacts for the operation of parallel alarms, common pre-alarm and shut down alarm by the Purchaser wherever indicated. All lamps shall be provided with lamp test facility.

j) Gauge glasses shall be provided for all level measurements requiring automatic or manual control or monitoring. They shall have at least the same pressure and temperature rating as that of equipment's on which they are to be installed. They shall have ball check auto shut off valves.

k) Isolation and bypass valves shall be installed with all control valves. Hand wheels and air lock valves shall be considered for all control valves.

l) Control valve sizing formula shall, in general, be as per ISA-75, 07. Control valves shall be sized for the available pressure drop at normal flow and shall permit up to 110% of the maximum flow. The Bidder shall submit the sizing calculations for all control valves. DP shut off shall be 10% more than upstream pressure for actuator sizing.

m) Orifice plate calculations shall in general, follow BS 1042. Orifice diameters shall be selected so that d/D ratio is between 0.2 to 0.7 for gases and steam and up to 0.75 for liquids. Bidder shall submit the sizing calculations for orifice plates.

n) Main steam generator stop valve & air vent valve will be motorized and shall be designed in accordance with ASME code for valves (ASME B 16.34) and Indian Boiler Regulations.

o) All transmitters shall be provided with output meter/output gauge at the transmitters end. All transmitters will be smart type.

p) The Bidder shall ensure that the packing of instruments and associated equipment is adequate to prevent damage from such contingencies as rough handling, weather, condensation, dew, vermin and vibrations.

q) All solenoid valves shall be universal type and continuous rated type.

r) Bidder will adhere to the approved makes for all instruments as provided in this document. Bidder will provide data sheets for all gauges, transmitters, thermo-wells, flow meters, energy meters, electrical meters, orifice, vortex meters, rota meters, impulse piping, etc. for approval of Purchaser / Consultant during engineering

Basic Controls Design

- 10% of Critical AI/AO/DI/DO signals will be redundant while balance non-critical & DAS points will be non-redundant.
- All controllers for critical controls will be redundant. The field inputs for critical inputs will be1/2 logics.
- Sequence of event recorder will be provided.
- Required Annunciation windows shall be included.
- 20% spare I/O's to be considered over & above connected I/Os.
- All I/O's will be potential free.

Estimated Bill Of Material

Sr. No	Description
	DCS System
I	I/O count to be derived by Bidder and approved by Consultant / Purchaser **(minimum 1200 I/Os envisaged)**
II	**Redundant Server or One Engineering cum operator station & 4 Sets of operator stations**, TFT 22" color monitors, 1 color graphic laser printer and 1 A3 Dot matrix printer, required consoles with chairs, required hardware for SOE recorder, LED digital displays (150 x 250 mm) for Process Parameters
III	Interconnecting cables between System Cabinets Marshalling cabinets Relay Cabinets
IV	Power Cable for system cabinets
V.	**Erection Hardware**
1.	Erection Material
2.	Cable Gland Wiring and cabling accessories
VI.	UPS Parallel Redundant with 3 Hours battery backup.
VII.	**Software**
	Runtime + Development
	Run time software
	Project – application engineering Documentation Supervision of installation & commissioning
VIII.	Field calibration instrument Function: Smart transmitter calibration and HART communication Accessories: (a) case & manuals (b) battery pack with AA batteries (c) lead set
IX	Software link RS485, mod bus protocol for temperature scanner, temperature scanner
X	Bidder to provide the DCS with required software & compatibility with internet so as to transfer daily / shift wise MIS to Management / Senior officers of Plant

Uninterrupted Power Supply (UPS)

Scope Of Work

General Information		
Rated voltage	:	230 VAC
Rated frequency	:	50 Hz
Rated power	:	Minimum 10 KVA or above
Backup time @ 10 KVA	:	3 Hrs Min.
Configuration	:	Parallel redundant
Codes / Standards	:	IS

Specifications of UPS

Requirement

The Bidder shall supply minimum 10 kVA or 25% higher than peak requirement, parallel redundant Online Un - interrupted Power Supply (UPS) in the scope *(UPS output to be generated continuously through Battery).* UPS with AC distribution board and accessories shall meet AC requirements of instruments, instrument panel and other Purchaser's loads. Bidder to supply power sizing of UPS for approval prior to finalizing of the same.

Standards

The equipment covered by this specification shall be in line with the requirements of the following IS, unless otherwise specified.

IS 1248 Direct acting electrical indicating instruments.
IS 3136 Polycrystalline semiconductor rectifier equipment
IS 3700 Essential ratings and characteristics of semiconductor devices.
IS 3895 Mono-crystalline semiconductor rectifier cells and stacks
IS 4540 Mono-crystalline semiconductor rectifier assemblies
IS 5001 Guide for preparation of drawings of semiconductor devices
IS 5060 Code of practice for use of semiconductor junction devices

System Operation

The uninterrupted power supply system shall be complete with chargers, inverters, static switches, bypass transformer with Automatic voltage regulator and manual bypass switch. Normally the system will supply the load in UPS mode. In case of any trouble with one of the Inverter Sections, the load shall be catered by the redundant system if both the inverters fail, loads shall be transferred to the bypass transformer without any interruption.

A manual by pass switch (make before break) shall be provided to isolate the inverters and static switches for maintenance.

When it becomes necessary to boost charge the battery (i.e. when the battery has discharged during mains failure), the charger shall be set to the boost mode manually. The rectifier section shall now cater for boost charging the battery and at the same time supplying the inverter. After completion of boost charging, the charger shall be reset to float mode manually.

It shall be possible to run the system at rated load for three hour and at about 75% load continuously without any damage in case of failure of cooling fans.

Design

The charger shall have necessary features to prevent damage to the battery. The output voltage (110 V AC, single phase and 230V AC single phase) shall be stabilised to within +/- 5% variation, for mains input (415 V AC, three phase) variation of +/- 20% in voltage and +/- 5% in frequency. The source fault level at the point of supply shall be 50 MVA. Charger shall have adjustable current limiting feature controlling the output current and the battery current in float and boost mode. Charger output to the battery shall be passed through a smoothing circuit so that the ripple content is limited to a value safe for the battery.

The charger shall be designed to boost charge the completely discharged, batteries in 10 hours. The changeover between boost charge mode and float charge mode shall be affected manually. Necessary alarms to indicate battery discharged and DC over voltage conditions shall be provided. Selector switch shall be provided for selecting the float charge or boost charge mode.

The inverter unit shall be designed to operate from the charger output continuously without use of battery smoothing effect. With the battery connected to the UPS system, a filter shall be provided at the input of inverter unit to reduce-the AC feedback from the inverter to the battery to a maximum of 2%. Efficiency of the Inverter shall not be less than 80% at rated load and pf. The output waveform distortion shall not be greater than 3%.

The inverters shall be suitable for synchronising with the mains having frequency variation of +/- 3%. The inverters shall be de-linked when the variation exceeds this and shall run on its own oscillator maintaining its output frequency to +/- 1 % of 50 Hz.

Current limit protection shall be provided which will protect the inverter against overloads and short circuits at the output. The current limit shall be adjustable. Once the overload is removed, the inverter shall automatically resume normal operation.

UPS shall be designed to withstand 125% overload for 15 minutes and 150% overload for 10 seconds.

The inverter output shall have spike / surge suppression filters to protect the loads.

By-pass transformer shall be natural air-cooled type suitable for indoor location. Links shall be provided on 415 V windings to give offload tapings of +/- 2.5% & +/- 5% of normal voltage.

A manual Bypass switch, make before break type, shall be provided to take the system out for maintenance without interrupting power to the load. The switch shall be mounted in the inverter section. The enclosure to be of IP 3X or better.

The Bidder shall ensure that neutral of the all transformers are solidly connected to earth to ensure that the potential between earth and neutral is zero at all conditions

Cabinets

The UPS shall be housed in a 2 mm thick sheet steel Cabinet with separated panels for housing the charger, inverter and Bypass transformer. The panels shall be freestanding, front aligned, dust and Vermin proof with suitable ventilation Louvers and cooling fan. Hinged doors shall be provided at the front and back, as required, with dust tight gaskets. Inter panel sheet steel barriers shall be used.

The enclosure degree of protection shall be minimum IP 21. The cable entry shall be from the bottom. A removable bottom gland plate shall be provided fitted with double compression type cable glands for external cable connections. Elmex type clamp terminals shall be provided for wires up to 16 sq. mm. and terminals for, large size shall be bolted type complete with cable lugs.

All switches shall be rotary type mounted on the front of the door. Fuses shall be HRC link type. Busbars shall be colour coded and live parts shall be properly shrouded to ensure complete safety to operating / maintenance personnel. All instruments shall be switchboard type, back connected, 96 mm square. Scale shall have red mark indicating maximum rating.

An earth bus, suitably sized, shall be provided at the bottom of the panels with provision for earth connection at both ends to existing main earth grid. All non-current carrying metallic parts shall be earthed.

Anti-condensation heaters, thermostatically controlled shall be provided in each vertical panel complete with switch fuse unit/MCB.

Each panel shall be provided with one 5A receptacle and switch and panel lighting.

Distribution board at the outlet of UPS system shall be provided with adequately sized incomer FSU (single phase) and outgoing FSU feeders as below, for continuous use.

a. Incomer 250 Amps - 1 No.
b. Outgoing 32 Amps - 3 Nos.
c. Outgoing 16 Amps - 6 Nos.

Battery

Set of indoor sealed maintenance-free battery of capacity to meet the UPS back -up requirement for Three hours with all necessary accessories and devices as required for satisfactory functioning of the system shall be included in scope.

By pass Supply Voltage Stabilizer

By pass supply shall be taken through servo stabilizer.

Voltage stabilizer output regulation shall be + / - 1 % for 0-100% load variation and full range of input supply variation over the entire power factor range.

Static Switches

Static switches shall be solid state with performance characteristics matching with the Inverters. Controls permitting manually actuated transfers to either source shall be provided. Actuating device of such controls shall be so located or guarded to prevent accidental operation. On the front of panel an indication shall be provided for each static switch to show its position.

Metering, Indications and Alarms

The following metering and indications shall be provided on each panel:

Charger Panel

a. Incomer AC supply voltage with selector switch
b. Incomer AC line current with selector switch
c. Output voltage charger
d. Output current charger
e. Battery charging/discharging current
f. Indicating lamps for A. C input & output supply 'ON.
g. Indicating lamps for battery on float / Boost.

Inverter Panel

a. D.C. Input current
b. Bypass transformer secondary voltage
c. UPS output voltage with selector switch
d. UPS output current with selector switch
e. Frequency meter
f. Power factor meter
g. Indicating lamp for Battery output 'ON'.
h. Bypass supply 'ON'
i. Load on Bypass
j. Mains synchronized.

Audio Visual Alarm

To be provided for the following complete with ACCEPT, RESET and TEST facilities

Charger Panel

a. Mains under Voltage, single phasing, in case of three phase input.
b. Charger / Diode Failure
c. Cooling fan tripped (Common for all fans)

d. Low battery voltage
e. DC over-voltage
f. Battery earth fault

Inverter panel

a. DC input failure
b. Inverter -1 output failure
c. Inverter -II output failure
d. Load-on by pass
e. SCR fuse failure
f. UPS output under voltage

Potential free 'NO' contacts for annunciation for all the above mentioned alarms shall be provided, wired up to terminal strip and to be grouped separately for charger and inverter unit.

Inspection and Testing:-

The following tests shall be carried out on the system to ensure its successful operation as per the specification.

The system shall run under rated load at rated power factor for a minimum continuous period of 10 hours. Output voltage, current, frequency and critical temperatures shall be recorded. Test shall also be done with the fans off and the system loaded as described in this specification.

Output voltage and frequency regulations on various load combinations from 0-10 % load.

Over load withstand test as per this specification shall be carried out immediately after continuous operation on rated full load and maximum operating temperature (hot condition).

Waveform analysis with Oscilloscope under the following conditions shall be done.

Full load conditions

Simulation of input AC-power failure to the rectifier.

Simulation of battery charger failure and battery failure.

Simulation of failure of inverters (causing the full load to be transferred to the By Pass supply)

Manual return of full load at rated power factor from Bypass supply to the inverter.
Short circuit the output bus to record the current limiting effect of the inverter.

Reverse input polarity test.

Test on all controls and Alarms for correct setting and operation. Test and calibrate the instruments.

TENTATIVE SECTIONWISE INSTRUMENTAT LIST

Below is the tentative list & type of instruments to be installed in each section.

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
MOLASSES HANDLING AND WEIGHING SYSTEM			
1	Molasses weighing system with accessories	Load Cell	1
2	Molasses weighing system Inlet ON / OFF Valve	ON / OFF Type	1
3	Molasses weighing system Outlet ON / OFF Valve	ON / OFF Type	1
PRESSURE GUAGES			
1	Day Tank feed pump	Diaphragm type	2
2	Molasses Day transfer pump	Diaphragm type	2
3	Weighed Molasses transfer pump	Diaphragm type	2

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
FERMENTATION SECTION			
MFT			
1	Mag. Flow Trans. for Molasses to Fermenters (F1,F2,F3,F4)	MFT	4
2	Mag. Flow Trans. to Broth Mixer	MFT	1
LEVEL TRANSMITTER			
1	Level Trx for F1-F4,wash holding tank	Flanged end	5
ROTAMETER			
1	Process water to the Fermenters (F1,F2,F3,F4)	GTRT	4
2	Process water to the Pre Fermenter.	GTRTS	3
3	Process water to the co2 scrubber	GTRTS	1
4	Process water to Air Blower 1 and 2	GTRTS	2

RTD WITH TT			
1	Pre Fermenter Yeast Vessals 1, 2, & 3	RTD with TT	5
2	Fermenters (F1,F2,F3,F4)	RTD with TT	4
3	Fermentation CWR &CWS line	RTD with TT	2
4	Wash holding tank	RTD with TT	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
FERMENTATION SECTION			
PRESSURE GUAGES			
1	Pre fermenter recirculation pump	Diaphragm type	2
2	Fermenters (F1, F2, F3, F4) of recirculation pump.	Diaphragm type	5
3	CIP pump	Bourdon tube type	2
4	Process water to the Pre Fermenters.	Bourdon tube type	1
5	Process water to the co2 scrubber	Bourdon tube type	1
6	Process water to Air Blower 1 and 2	Bourdon tube type	2
7	Wash transfer pump to analyzer column	Diaphragm type	2
8	Wash holding tank pump	Diaphragm type	2
9	Sludge transfer pump to decanter	Diaphragm type	2
10	Fermentation cooling tower pump	Bourdon tube type	2
11	Nutrient dosing, antifoam pumps	Bourdon tube type	4
Foam Sensors			
1	Foam Sensors For Fermenters F1-F4	Conductive Electrode Type	4

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
DISTILLATION SECTION			
FLOW TRANSMITTERS (MFT/VFT)			
1	Fermented wash feed to Distillation	MFT	1
2	PRC, RCII ND and Refining Bottom DRAW	VFT	3
FLOW TRANSMITTERS (OFT)			
1	Steam to PRC Column Reboiler	OFT	1
2	Steam to RC IInd Column Reboiler	OFT	1
3	Steam to Hydro Column Reboiler	OFT	1
4	Steam to fusel Column Reboiler	OFT	1
5	PRC reflux	MTRT	1
6	RC IInd Reflux	MTRT	1
7	Hydro reflux	MTRT	1
8	fusel reflux	MTRT	1
9	Refining reflux	MTRT	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
DISTILLATION SECTION			
PRESSURE CONTROL VALAVE			
1	Degasser Column Top pressure control valve	Globe Valve	1
2	Rectifier cum exhaust column Top pressure control valve	Globe Valve	1
3	Rectifier IIND column Top pressure control valve	Globe Valve	1
4	Defusel column Top pressure control valve	Globe Valve	1
FLOW CONTROL VALAVE			
1	FW Feed to Distillation	Globe Valve	1
2	Steam to PRC Column	Globe Valve	1
3	Steam to RC IInd Column	Globe Valve	1
4	Steam to Hydro Column	Globe Valve	1
5	Steam to Defusel Column	Globe Valve	1
6	PRC reflux	Globe Valve	1
7	RC IInd Reflux	Globe Valve	1
8	Hydro reflux	Globe Valve	1
9	Defusel reflux	Globe Valve	1
10	Refining reflux	Globe Valve	1
11	PRC RS Draw control valve	Globe Valve	1
12	RCIIND RS Draw control valve	Globe Valve	1
13	Refining ENA draw control	Globe Valve	1
PRESSURE TRANSMITTER			
1	Degasser top pressure	Diaphragm type	1
2	Primary top pressure	Diaphragm type	1
3	Primary bottom pressure	Diaphragm type	1
4	Rectifier cum exhaust column top pressure	Diaphragm type	1
5	Rectifier exhaust column bottom pressure	Diaphragm type	1
6	Rectifier IInd column bottom pressure	Diaphragm type	1
7	Rectifier IInd column top pressure	Diaphragm type	1
8	Hydro column top pressure	Diaphragm type	1
9	Defusel column top pressure	Diaphragm type	1
10	Refining column top pressure	Diaphragm type	1
11	Steam Header	Diaphragm type	1
12	Cooling water supply header	Diaphragm type	1
ROTAMETER			
1	IS Draw	GTRT	1
2	PROCESS WATER TO Alde.	GTRT	1
3	Rectifier cum exhaust column IS CUT	GTRT	1
4	Dealdehyde IS CUT	GTRT	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
DISTILLATION SECTION			
5	PW FOR BOTH FO DECANTERS	GTRT	1
6	LFO / HFO For RC	GTRT	1
7	Soft water for Vacuum Pump, & Scrubber	GTRT	1
8	Hydro IS CUT	GTRT	1
9	Defusel IS CUT	GTRT	1
10	RC IInd IS CUT	GTRT	1
11	Refining IS CUT	GTRT	1
12	PRC LFO CUT	GTRT	1
13	PRC HFO CUT	GTRT	1
14	RCII ND LFO CUT	GTRT	1
15	RCIIND HFO CUT	GTRT	1
16	Defusel LFO CUT	GTRT	1
17	Defusle HFO CUT	GTRT	1
18	Hydro ester CUT	GTRT	1
19	Fusle oil decanter dilution water	GTRT	1
PRESSURE GUAGES			
1	Primary column bottom	Bourdon tube type	1
2	Dealdehyde Column bottom	Bourdon tube type	1
3	Rectifier cum exhaust column bottom	Bourdon tube type	1
4	RC-II column bottom	Bourdon tube type	1
5	Hydro Column bottom	Bourdon tube type	1
6	Defusel column bottom	Bourdon tube type	1
7	Refining Column bottom	Bourdon tube type	1
8	Steam Header	Bourdon tube type	2
9	Air Header	Bourdon tube type	2
10	CWS Header	Bourdon tube type	2
11	Dist Cooling tower pump	Bourdon tube type	2
12	Primary Condensate Transfer Pump	Bourdon tube type	2
13	Rectifier Reflux pump	Bourdon tube type	2
14	Rectifier bottom	Bourdon tube type	2
15	Vinasse transfer Pump	Bourdon tube type	2
16	Vinasse recycle Pump	Bourdon tube type	2
17	I.S Cut transfer pump	Bourdon tube type	2
18	Fusel Oil washing collection pump	Bourdon tube type	2
19	Steam condensate transfer Pump	Bourdon tube type	2
20	Vacuum Pumps	Bourdon tube type	2
21	Scrubber water Pumps	Bourdon tube type	2
22	Fusel Oil reflux pump	Bourdon tube type	2
23	Hydro bottom Pump	Bourdon tube type	2
24	Hydro reflux Pumps	Bourdon tube type	2

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
DISTILLATION SECTION			
25	RC IIND BOTTOM Pumps	Bourdon tube type	2
26	RCIIND Reflux pump	Bourdon tube type	2
27	Fusel oil feed Pump	Bourdon tube type	2
28	Refining reflux Pumps	Bourdon tube type	2
29	Refining bottom pump	Bourdon tube type	2
30	Scrubbers water transfer pump	Bourdon tube type	2
LEVEL TRANSMITTER			
1	Primary column	Remote seal	1
2	Dealdehyde column	D.P. TRX	1
3	Rectifier cum exhaust column	D.P. TRX	1
4	Rectifier IInd column	D.P. TRX	1
5	Hydro column	D.P. TRX	1
6	Defusel column	D.P. TRX	1
7	Refining column	D.P. TRX	1
8	Steam condensate Tank	D.P. TRX	1
9	Primary condensate tank	D.P. TRX	1
10	Dealdehyde feed Tank	D.P. TRX	1
11	PRC RefluxTank	D.P. TRX	1
12	RCIIND Reflux tank	D.P. TRX	1
13	Hydro reflux Tank	D.P. TRX	1
14	Defusel feed Tank	D.P. TRX	1
15	Defusle reflux tank	D.P. TRX	1
16	Refining reflux tank	D.P. TRX	1
17	IS collection Tank	D.P. TRX	1
LEVEL CONTROL VALAVE			
1	Primary column bottom	Globe Valve	1
2	Rectifier cum exhaust column bottom	Globe Valve	1
3	Hydro column bottom	Globe Valve	1
4	Refining Column bottom	Globe Valve	1
5	Rectifier IIND column bottom	Globe Valve	1
6	Defusel column bottom	Globe Valve	1
7	Dealdehyde feed tank	Globe Valve	1
8	Steam condensate Tank	Globe Valve	1
9	Dealdehyde Reflux Tank	Globe Valve	1
10	Primary Condensate tank	Globe Valve	1
11	IS collection Tank	Globe Valve	1
12	PRC Reflux Tank	Globe Valve	1
13	RC IInd reflux tank	Globe Valve	1
14	Hydro reflux Tank	Globe Valve	1
15	Defusel Reflux Tank	Globe Valve	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
DISTILLATION SECTION			
16	Defusel feed tank	Globe Valve	1
17	Refining reflux Tank	Globe Valve	1
18	Vinasse recycle tank	Globe Valve	1
RTD WITH TEMPERATURE TRANSMITTER			
1	Primary column bottom	RTD with TT	1
2	Primary column top	RTD with TT	1
3	Degasser column TOP	RTD with TT	1
4	Dealdehyde Column top	RTD with TT	1
5	Dealdehyde Column bottom	RTD with TT	1
6	Rectifier cum exhaust column bottom	RTD with TT	1
7	Rectifier cum exhaust column top	RTD with TT	1
8	Rectifier cum exhaust column LFO	RTD with TT	1
9	Rectifier cum exhaust column HFO	RTD with TT	1
10	Rectifier cum exhaust column RS Draw	RTD with TT	1
11	Rectifier IIND column bottom	RTD with TT	1
12	Rectifier IIND column top	RTD with TT	1
13	Rectifier IIND column LFO	RTD with TT	1
14	Rectifier IIND column HFO	RTD with TT	1
15	Rectifier IIND column RS Draw	RTD with TT	1
16	Hydro column bottom	RTD with TT	1
17	Hydro column top	RTD with TT	1
18	Hydro column Ester	RTD with TT	1
19	Refining column bottom	RTD with TT	1
20	Refining column top	RTD with TT	1
21	Defusel column bottom	RTD with TT	1
22	Defusel column top	RTD with TT	1
23	Defusel column LFO	RTD with TT	1
24	Defusel column HFO	RTD with TT	1
25	Steam condensate Tank	RTD with TT	1
26	Rectifier Vent Condenser.	RTD with TT	1
27	Primary column reboiler Vent condenser	RTD with TT	1
28	Dealdehyde condenser I	RTD with TT	1
29	Dealdehyde condenser II	RTD with TT	1
30	PRC first condenser	RTD with TT	1
31	PRC second condenser	RTD with TT	1
32	Mash preheater	RTD with TT	1
33	Hydro condenser	RTD with TT	1
34	Defusel condenser	RTD with TT	1
35	Refining condenser	RTD with TT	1
36	RS Cooler	RTD with TT	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
DISTILLATION SECTION			
37	ENA Cooler	RTD with TT	1
38	IS Cooler	RTD with TT	1
39	Rectifier column Bottom PHE	RTD with TT	1
40	Vinasse PHE	RTD with TT	1
41	Vinasse Recycle PHE	RTD with TT	1
42	Soft water PHE	RTD with TT	1
43	Fusel Oil Cooler	RTD with TT	1
44	Steam Header	RTD with TT	1
45	Cooling Water Supply header	RTD with TT	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
MOLECULAR SIEVE DEHYDRATION SECTION			
LEVEL TRANSMITTER			
1	RECOVERY COLUMN (C-501) LEVEL	D.P. TRX	1
2	RECOVERY TANK(T-502) LEVEL	D.P. TRX	1
3	VACUUM DRUM (D-502) LEVEL	D.P. TRX	1
4	R.S. FEED TANK(T-501)	D.P. TRX	1
5	PRODUCT RECIEVER TANK(T-503)	D.P. TRX	1
LEVEL CONTROL VALVE			
1	RECOVERY COLUMN (C-501) LEVEL	Globe Valve	1
2	RECOVERY TANK(T-502) LEVEL	Globe Valve	1
3	VACUUM DRUM (D-502) LEVEL	Globe Valve	1
4	R.S. FEED TANK (T-501)	Globe Valve	1
5	PRODUCT RECIEVER TANK (T-503)	Globe Valve	1
FLOW TRANSMITTERS (VFT/OFT)			
1	STEAM TO RECOVERY COLUMN REBOILER(HE-501)	ORIFICE PLATE WITH DPT	1
2	ALC VAPOURS TO ABSORBER DRUM(D-501A/B)	VORTEX FLOW TRANSMITTERS	1
3	RS FEED PUMP TO RECOVERY COLUMN (C-501)	VORTEX FLOW TRANSMITTERS	1
4	PRODUCT RECIEVER TANK(T-503)	VORTEX FLOW TRANSMITTERS	1
5	STEAM TO SUPER HEATER(HE-504)	ORIFICE PLATE WITH DPT	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NOS)
MOLECULAR SIEVE DEHYDRATION SECTION			
FLOW CONTROL VALVE			
1	STEAM TO RECOVERY COLUMN REBOILER(HE-501)	Globe Valve	1
2	ALC VAPOURS TO ABSORBER DRUM(D-501A/B)	Globe Valve	1
3	STEAM TO SUPER HEATER(HE-504)	Globe Valve	1
PRESSURE TRANSMITTER			
1	ALC VAPOURS TO PRODUCT VAPOUR CONDENSER	Diaphragm type	1
2	RECOVERY TANK(T-502) TOP PRESSURE	Diaphragm type	1
3	ABSORBER. DRUM (C-501A) INLET PRESSURE	Diaphragm type	1
4	ABSORBER DRUM(C-501B) INLET PRESSURE	Diaphragm type	1
5	RECOVERY COLUMN (C-501) TOP PRESSURE	Diaphragm type	1
6	RECOVERY COLUMN (C-501) BOTTOM PRESSURE	Diaphragm type	1
ON-OFF VALVE			
1	on-off valve	PNEUMATIC ACTUATED VALVE	9
PRESSURE CONTROL VALVE			
1	ALC VAPOURS TO PRODUCT VAPOUR CONDENSER	Globe Valve	1
RTD WITH TT			
1	Recovery Column top ,middle and bottom	RTD with TT	3
2	RS TO RECOVERY COLUMN	RTD with TT	1
3	SUPER HEATER OUTLET (ALC. VAPOUR) (HE 504)	RTD with TT	1
4	Molecular Sieve Drum top, middle and bottom for both drum qty-6 nos	RTD with TT	6
5	CWR - MOL. SIEVE CONDENSER	RTD with TT	1
6	CWR - WEAK ALCOHOL CONDENSER	RTD with TT	1
7	SUB COOLER FOR ETHANOL	RTD with TT	1
8	CWR - WEAK ALCOHOL COOLER	RTD with TT	1
9	Weak Alcohol Recirculation Cooler	RTD with TT	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
MOLECULAR SIEVE DEHYDRATION SECTION			
PRESSURE GUAGES			
1	Feed Pump	Bourdon tube type	2
2	Weak Alcohol Recirculation Pump	Bourdon tube type	2
3	Vacuum Pump	Bourdon tube type	2
4	Product Pump	Bourdon tube type	2

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NO.S)
STORAGE SECTION			
PD METER			
1	PD METER	Mechanical	3
PRESSURE GUAGES			
1	ENA TRANSFER PUMP	Bourdon tube type	2
2	ETHANOL TRANSFER PUMP	Bourdon tube type	2
3	RS TRANFER PUMP	Bourdon tube type	2
4	IS TRANSFER PUMP	Bourdon tube type	2

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NOS)
INTEGRATED EVAPORATION			
LEVEL TRANSMITTERS			
1	EFFLUENT FEED TANK	REMOTE SEAL	1
2	PROCESS CONDENSATE	DPT	1
3	CONCENTRIC SPENT WASH TANK	REMOTE SEAL	1
4	EVAPORATOR –I, II, III, Stand By	REMOTE SEAL	4
CONTROL VALVES			
1	EFFLUENT FEED TANK	GLOBE	1
2	PROCESS CONDENSATE	GLOBE	1
3	EVAPORATOR –I, II, III, Stand By	GLOBE	4
4	SPENT FEED CONTROL	GLOBE	1
5	STEAM FLOW CONTROL	GLOBE	1
PRESSURE TRANSMITTERS			
1	VAPOUR LIQUID SEPERATOR- I, II, III, Stand By	Diaphragm	4

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NOS)
INTEGRATED EVAPORATION			
TEMPERATURE ELEMENTS (RTD)			
1	TEMPERATURE OF FEED INLET TO PHE	RTD with TT	1
2	TEMPERATURE OF FEED OUTLET OF PHE	RTD with TT	1
3	TEMP. OF VAPOUR-LIQUID SEPARATOR- I, II, III, Stand By TOP	RTD with TT	4
4	TEMPERATURE OF CWR	RTD with TT	1
5	TEMPERATURE OF CWS	RTD with TT	1
FLOW TRANSMITTERS			
1	SPENT WASH FEED	MAGNETIC FLOW METER	1
2	CONC.PRODUCT OUT	MAGNETIC FLOW METER	1
3	PROCESS CONDENSATE OUT	MAGNETIC FLOW METER	1
FLOW INDICATORS			
1	SOFT WATER TO VACUUM PUMP	GLASS TUBE ROTAMETER	1
PRESSURE INDICATORS			
1	Motor for Circulation Pump I, II, III, Stand By	DIAPHRAGM	4
2	Motor for Spent Wash Pump	DIAPHRAGM	1
3	Motor for Process condensate pump	BOURDON	1
4	Motor for Conc. Spent wash Feed Pump	DIAPHRAGM	1
6	Motor for VP Seal Water Pump	BOURDON	1
7	Motor for CIP Pump.	BOURDON	1
8	Motor for m/c sealing water Transfer Pump	BOURDON	1
9	Motor for Cooling Tower Pump	BOURDON	1
10	VAPOUR LIQUID SEPERATOR I, II, III, Stand By	BOURDON / DIAPHRAGM	4
11	RAW SPENT WASH INLET TEMPERATURE	BIMETALLIC	1
12	PROCESS CONDENSATE INLET TEMP TO PHE-602	BIMETALLIC	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NOS)
STAND ALONE EVAPORATION			
LEVEL TRANSMITTERS			
1	EFFLUENT FEED TANK	REMOTE SEAL	1
2	PROCESS CONDENSATE	DPT	1
3	CONCENTRIC SPENT WASH TANK	REMOTE SEAL	1
4	STEAM CONDENSATE TANK	DPT	1
5	DIRTY CONDENSATE TANK	REMOTE SEAL	1
6	EVAPORATOR –I, II, III, IV, V, Stand By	REMOTE SEAL	6
CONTROL VALVES			
1	EFFLUENT FEED TANK	GLOBE	1
2	PROCESS CONDENSATE	GLOBE	1
3	STEAM CONDENSATE TANK	GLOBE	1
4	DIRTY CONDENSATE TANK	GLOBE	1
5	EVAPORATOR –I, II, III, IV, V, Stand By	GLOBE	6
6	SPENT FEED CONTROL	GLOBE	1
7	STEAM FLOW CONTROL	GLOBE	1
PRESSURE TRANSMITTERS			
1	VAPOUR LIQUID SEPERATOR- I, II, III, IV, V, Stand By	Diaphragm	6
TEMPERATURE ELEMENTS (RTD)			
1	TEMPERATURE OF FEED INLET TO PHE	RTD with TT	1
2	TEMPERATURE OF FEED OUTLET OF PHE	RTD with TT	1
3	TEMP. OF VAPOUR-LIQUID SEPARATOR- I, II, III, IV, V, Stand By TOP	RTD with TT	6
4	TEMPERATURE OF CWR	RTD with TT	1
5	TEMPERATURE OF CWS	RTD with TT	1
FLOW TRANSMITTERS			
1	SPENT WASH FEED	MAGNETIC FLOW METER	1
2	CONC.PRODUCT OUT	MAGNETIC FLOW METER	1
3	PROCESS CONDENSATE OUT	MAGNETIC FLOW METER	1
4	STEAM INLET	OFA+DPT	1
FLOW INDICATORS			
1	SOFT WATER TO VACUUM PUMP	GLASS TUBE ROTAMETER	1
PRESSURE INDICATORS			
1	Motor for Circulation Pump I, II, III, IV, V, Stand By	DIAPHRAGM	6
2	Motor for Spent Wash Pump	DIAPHRAGM	1
3	Motor for Process condensate pump	BOURDON	1

SR.NO.	DESCRIPTION	TYPE OF INSTRUMENT	QTY. (NOS)
STAND ALONE EVAPORATION			
4	Motor for Conc. Spent wash Feed Pump	DIAPHRAGM	1
5	Motor for Steam Condensate Pump	BOURDON	1
6	Motor for VP Seal Water Pump	BOURDON	1
7	Motor for CIP Pump.	BOURDON	1
8	Motor for m/c sealing water Transfer Pump	BOURDON	1
9	Motor for Dirty condensate transfer Pump	BOURDON	1
10	Motor for Cooling Tower Pump	BOURDON	1
11	VAPOUR LIQUID SEPERATOR I, II, III, IV, V, Stand By	BOURDON / DIAPHRAGM	6
12	STEAM INLET PRESSURE BEFORE PRV	BOURDON	1
13	RAW SPENT WASH INLET TEMPERATURE	BIMETALLIC	1
14	PROCESS CONDENSATE INLET TEMP TO PHE-602	BIMETALLIC	1
15	STEAM LINE TEMPERATURE	BIMETALLIC	1

Note: -

1. **The above list is tentative and minimum. Bidders to add the instruments wherever applicable as per process requirement.**
2. **All the Transmitters will be SMART Type**
3. **The required accessories will be part of instruments**
4. **All the Flow meters to be provided with Remote Display Unit.**
5. **24 VDC auxiliary power supply to be provided to 2 Wire systems including flow meters**
6. **The detailed instrument list to be furnished by the Bidder along with the control philosophy & control logics**

3.6 PRODUCT STORAGE AREA

This section intends to specify the basis for the design of Ethyl Alcohol / ENA storage area based on minimum essential requirement as per statutory rule & regulation, for stable performance throughout year.

The daily receivers and bulk storage shall be designed for daily production capacity, two different product like Rectified spirit, Ethanol along with Impure alcohol and fusel oil.

Mentioned capacity for each tank is ONE number

Receiver and bulk storage area layout, all tanks shall be designed, manufactured and approved latest amendments of Applicable Process and Mechanical design, statutory regulation and safety aspect to plant itself and environment considering all principle of Engineering.

Layout and equipment elevation for Ethanol day receiver and bulk storage shall be as per PESO rule.

TANK FARM: -

Sr No.	Particulars	Working Capacity (M^3)	MOC	Thickness (mm) Bottom/ Shell/top	Qty (Nos)
1.	RS Receiver	30	MS IS-2062	As per API 650	3
2.	ENA Receiver	30	MS IS-2062	As per API 650	3
3.	AA Receiver (Shall be design as per PESO rule)	30	MS IS-2062	As per API 650	3
4.	Impure alcohol receiver	2	MS IS-2062	As per API 650	3
5.	Fusel Oil Storage	5	MS IS-2062	As per API 650	2
6.	Impure spirit Main Storage	50	MS IS-2062	As per API 650	1
7.	RS Main Storage	450	MS IS-2062	As per API 650	2
8.	ENA Main Storage	450	MS IS-2062	As per API 650	2
9.	AA Main Storage (Shall be design as per PESO rule)	450	MS IS-2062	As per API 650	3

Sr No.	Particulars	Working Capacity (M^3)	MOC	Thickness (mm) Bottom/ Shell/top	Qty (Nos)
10.	Vent Condensers with necessary piping valves, flame arrester	1.5 m2	SS 304	25.4/1.2/2	8
11.	PD flow meter with totaling for alcohol issue & measures with flexible SS hose pipe	30 m3/hr	SS 304	1 no each for RS/ENA/ AA	
12.	PD flow meter with totaling for alcohol issue & measures with flexible SS hose pipe	30 m3/hr	SS 304	1 no each for IS	

Note:

1. All tanks to be provided with level indicators in DCS.
2. All tanks shall have flame arresters and moisture trap.
3. Thicknesses mentioned are minimum, higher thickness may be required as per API 650/IS Standards.
4. Earthing & Lightening Arrestors to be provided wherever necessary to the Tanks as per the norms.

PUMPS WITH MECHANICAL SEAL AND FLAME PROOF MOTORS.

Sr. No.	Particulars	Wetted Part M.O.C.	Type	Cap.	KW	Qty (Nos.)
1.	R.S. pump (From day receiver tank to storage tank)	SS-304	Centrifugal	30 M^3/hr	To be specified	1+1
2.	R.S. pump (From storage tank to issue)	SS-304	Centrifugal	30 M^3/hr	To be specified	1+1
3.	ENA pump (From day receiver tank to storage tank)	SS-304	Centrifugal	30 M^3/hr	To be specified	1+1
4.	ENA pump (From storage tank to issue)	SS-304	Centrifugal	30 M^3/hr	To be specified	1+1
5.	Impure spirit pump (From day receiver to storage tank to issue)	SS-304	Centrifugal	3 M^3/hr	To be specified	1+1
6.	Fusel oil dispatch pump (From storage tank to issue)	SS-304	Centrifugal	2 M^3/hr	To be specified	1+1

Sr. No.	Particulars	Wetted Part M.O.C.	Type	Cap.	KW	Qty (Nos.)
7.	Ethanol pump (From day receiver tank to storage tank)	SS-304	Centrifugal	30 M^3/hr	To be specified	1+1
8.	Ethanol pump (From storage tank to issue)	SS-304	Centrifugal	30 M^3/hr	To be specified	1+1
9.	Rs feed pump to Distillery Plant	SS-304	Centrifugal	3 M^3/hr	To be specified	1+1

Note:

- All motors are flame proof with double mechanical seal.
- Pumps – 1+1 Nos. (1 No. in operation + 1 No. process standby)
- Non return valves (NRV) should be provided for each pump delivery line.
- Pressure gauge should be provided for each pump at suction & delivery.
- Safety guards for all motors.
- All flanges should be as per ASME/ANSI B 16.5
- All ball valves should be full port type only.
- All SS-304 Piping- Sch. 10.
- MS piping shall be minimum 'C' class.
- SDS unloading pump should be considered as RS issue pumps.

3.7 MULTI EFFECT EVAPORATION

This section intends to specify the basis for the design of standalone Evaporation plant. Multi effect evaporation Process after distillation and minimum essential requirement for stable and consistent performance of the plant for minimum 300 days every year operation.

Basis for Selection

1. Evaporator system shall be designed for raw spent wash integrated evaporation followed by standalone having solid concentration 14% to 15 % w/w concentration.
2. Evaporator system is ONE (for achieving desired solid concentration i.e. from 14 to 15 % solids in raw spent wash to 58-60 % solid concentration suitable for boiler) for 315 m3 per Day raw spent wash feed capacity, operates continuously, with highest possible solid concentration, minimum steam and power consumption and higher efficiency.
3. Evaporator system shall be designed to operate round the clock throughout the year for minimum 300 days.

DESIGN BASIS

Sr. No.	Specifications	Details
1.	Capacity:	13125 LPH
2.	Initial Solids	15% w/w solids
3.	Final Solids	60% w/w solids
4.	Feed pH	4 to 4.5
5.	Steam pressure & temperature	1.5 Bar (g) /116 Deg. C
6.	Evaporation Rate	9845 LPH.
7.	Concentrated product out.	3280 LPH

Note: - (Evaporation plant should handle variation in inlet solids from 14% to 15%)

TECHNICAL SPECIFICATIONS FOR STAND ALONE RAW SPENT WASH EVAPORATION

A. EQUIPMENT'S: -

Sr. No.	Particulars	Specifications
1.	**FEED Tank for Raw spent wash evaporation:** a. Type b. MOC c. Shell thick (mm) d. Capacity	 Vertical Cylindrical SS 304 4 15 m3
2.	**Evaporator Calendria-I (Falling Film Type)** a. MOC– (Shell, tube, bonnet, dish end & nozzles etc.) b. Shell thick (mm) c. HTA (M^2) d. Tube size- OD mmx Tube thick mm x Tube length (M)	 Shell – SS 304, Tube – SS 304 4 To be specified 50.8 X 1.6 X 12
3.	**Evaporator Calendria-II (Falling Film Type)** a. MOC– (Shell, tube, bonnet, dish end & nozzles etc.) b. Shell thick (mm) c. HTA (M2) d. Tube size- OD mmx Tube thick mm x Tube length (M)	 Shell – SS 304, Tube – SS 304 4 To be specified 50.8 X 1.6 X 12
4.	**Evaporator Calendria-III (Falling Film Type)** e. MOC– (Shell, tube, bonnet, dish end & nozzles etc.) f. Shell thick (mm) g. HTA (M^2) h. Tube size- OD mmx Tube thick mm x Tube length (M)	 Shell – SS 304, Tube – SS 304 4 To be specified 50.8 X 1.6 X 12
5.	**Evaporator Calendria** **Falling Film Type. (Stand By / Floating)** a. MOC– (Shell, tube, bonnet, dish end & nozzles etc.) b. Shell thick (mm) c. HTA (M^2) d. Tube size- OD mmx Tube thick mm x Tube length (M)	 Shell – SS 304, Tube – SS 304 4 To be specified 50.8 X 1.6 X 12
6.	**Evaporator Calendria –IV (Forced Circulation)** a. MOC– (Shell, tube, bonnet, dish end & nozzles etc.) b. Shell thick (mm) c. HTA (M^2) d. Tube size- OD mmx Tube thick mm x Tube length (M)	 Shell – SS 304, Tube – SS 316 4 To be specified 38 X 1.6 X 6
7.	**Evaporator Calendria –IV (Forced Circulation)** a. MOC– (Shell, tube, bonnet, dish end & nozzles etc.) b. Shell thick (mm) c. HTA (M^2)	 Shell – SS 304, Tube – SS 316 4

Sr. No.	Particulars	Specifications
	d. Tube size- OD mmx Tube thick mm x Tube length (M)	To be specified 38 X 1.6 X 6
8.	**Evaporator Calendria** **Forced Circulation Type. (Stand By / Floating)** a. MOC– (Shell, tube, bonnet, dish end & nozzles etc.) b. Shell thick (mm) c. HTA (M^2) d. Tube size- OD mmx Tube thick mm x Tube length (M)	Shell – SS 304, Tube – SS 316 4 To be specified 38 X 1.6 X 6
9.	**Vapor Separators for falling film Calendria - I** a. MOC b. Shell thick (mm) c. Diameter (mm) d. Height (mm)	SS 304 4 To be specified To be specified
10.	**Vapor Separators for falling film calendria – II** a. MOC b. Shell thick (mm) c. Diameter (mm) d. Height (mm)	SS 304 4 To be specified To be specified
11.	**Vapor Separators for falling film calendria - III** a. MOC b. Shell thick (mm) c. Diameter (mm) d. Height (mm)	SS 304 4 To be specified To be specified
12.	**Vapor Separators for falling film calendria (Stand By / Floating)** a. MOC b. Shell thick (mm) c. Diameter (mm) a. Height (mm)	SS 304 4 To be specified To be specified
13.	**Vapor Separators for forced Circulation Calendria - IV** a. MOC b. Shell thick (mm) c. Diameter (mm) d. Height (mm)	SS 304 5 To be specified To be specified
14.	**Vapor Separators for forced Circulation Calendria - V** a. MOC b. Shell thick (mm) c. Diameter (mm) d. Height (mm)	SS 304 5 To be specified To be specified

15.	**Vapor Separators for forced Circulation Calendria – Floating Body** a. MOC b. Shell thick (mm) c. Diameter (mm) d. Height (mm)	 SS 304 5 To be specified To be specified
16.	**Surface Condenser** a. Nos. b. MOC c. Shell thick (mm) d. Tube size- OD mmx Tube thick mm x Tube length (M) a. HTA (M^2)	 1 No Shell – SS 304, Tube – SS 304 38.1 X 1.2 X 6 To be specified To be specified
17.	**Product Tank for concentrated spent wash:** a. Type b. MOC c. Shell thick (mm) d. Capacity	 Vertical Cylindrical SS 304 3 3 m3
18.	**Process condensate Tank for evaporation condensate:** a. Type b. MOC c. Shell thick (mm) d. Capacity	 Vertical Cylindrical SS 304 5 5 m^3
19.	**Insulation and cladding** Insulation shall be provided to all equipment's and vapour ducts above 60^0 Wherever required.	75 MM thickness for equipment's and 60 MM for vapor ducting

B. Auxiliary

Sr. No.	Particulars	Specifications
1.	**Vapor Ducts** **a.** Material of Construction	 SS 304
2.	**Piping for** a. Condensate & non – condensate b. Feed and Final Product c. Cooling water d. Steam Condensate	 SS 304 SS 304 MS 'C' class MS 'C' class
3.	**Seal Water cooling system** a. Tanks: b. Pumps c. PHE d. Capacity	 To be specified To be specified To be specified To be specified

Sr. No.	Particulars	Specifications
	Separate close loop system shall be provided for Vacuum pump seal cooling system and other process flow pump seal cooling system.	

C. PUMP & MOTORS –WITH DOUBLE MECHANICAL SEAL

Sr. No.	Particulars	M.O.C.	Type	Capacity	Head in M.	Qty.
1.	Circulation Pumps for Calendria –I	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1 No
2.	Circulation Pumps for Calendria –II	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1 No
3.	Circulation Pumps for Calendria –III	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1 No
4.	Circulation Pumps for Floating FFE Calendria	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1 No
5.	Circulation Pumps for Calendria –IV	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1 No
6.	Circulation Pumps for Calendria –V	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1 No
7.	Circulation Pumps for floating FCE Calendria	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1 No
8.	Feed Pump for feed tank	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1W + 1SB
9.	Process Condensate Transfer Pump	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1W + 1SB
10.	Product Transfer Pump for product tank.	SS 316 Contact Parts	Centrifugal	To be specified	To be specified	1W + 1SB
11.	Vacuum Pump	SS 316 Contact Parts	To be specified	To be specified	To be specified	1W + 1SB

D. PIPING, FLANGES & VALVES-				
Sr. No.	**Particulars**	**M.O.C.**	**Class**	**Remark**
1.	Piping – (Including piping supports) a. Steam b. Spent wash	 MS-IBR SS-304	 -- --	For all SS-304 Piping - Sch.10
2.	Valves – a. Spent wash b. Steam	 SS-304 C.I.	 -- --	Specify type of valve

Note: –

- Pumps piping, fittings, pipe supports, valves, instrumentation & electrical items required for all utilities as per battery limit should be in the scope of Bidder. Bidder should specify all the details for this particular requirement.
- Sealing water system, soft water to all pumps gland-Intel and out let water header with piping and water collection tank, PHE and pumps to be provided.
- Pumps- 1+1 Nos. (1 No. in operation +1 No. process standby)
- Non return valves (NRV) should be provided for each pump delivery line.
- Pressure gauge should be provided for each pump at suction & delivery.
- Safety guards for all motors.
- All flanges should be as per ASME/ANSI B 16.5
- All ball valves should be full port type only.
- For piping every 12 M distance flanges should be provided.
- For all SS-304 Piping-Sch. 10.

B. UTILITIES:

Cooling Tower

Sr. No.	Particulars	Capacity	M.O.C.	Other details	Qty (No.)
1	Cooling tower for Evaporation	To be specified	Wooden	To be specified	1

Cooling water pump & Miscellaneous Items:

Sr. no.	Particular	Capacity	M.O.C.	Other detail	Qty (No.)
1	Cooling water circulation pump for Evaporation	To be specified	CI	To be specified	1+1

Note:

Pumps piping, fittings, pipe supports, valves, instrumentation & electrical items required for all utilities as per battery limit should be in the scope of Bidder. Bidder should specify all the details for this particular requirement.

- Sealing water system, soft water to all pumps gland-Intel and out let water header with piping and water collection tank, PHE and pumps to be provided.
- Pumps- 1+1 Nos. (1 No. in operation +1 No. process standby).
- Non return valves (NRV) should be provided for each pump delivery line.
- Pressure gauge should be provided for each pump at suction & delivery.
- Safety guards for all motors.
- All flanges should be as per ASME/ANSI B 16.5.
- All ball valves should be full port type only.
- For piping every 12 M distance flanges should be provided.
- All SS-304 Piping-Sch. 10.

SECTION – 4

TECHNICAL SPECIFICATIONS –

BALANCE MECHANICAL ITEMS OF PLANT

4.1 MECHANICAL BALANCE OF PLANT

1. Raw water/Filter water/Soft water/DM water lifting from proposed water treatment plant.
2. Water quantity is to be calculated & confirmed based on consumption of Process water for fermentation, DM water for ENA process, Soft Water for cooling tower make up, Washing, cleaning and misc.
3. Bidder shall consider the water requirement for start-ups, Stable operation, recycling of different stream, rejection at water treatment plant, and peak loads requirement.
4. Molasses unloading facility for procured molasses like unloading pit and pump and piping.
5. Bidder to consider live steam, temperature and pressure, turbine exhaust with PRDS at distillery end considering the requirement of temperature and pressure of steam for process.
6. Bidder to consider Steam condensate generation from Distillation & evaporation, where ever steam is used and recycling back this to Boiler as feed water considering the distance system pressure and pressure at feed tank, system is to be designed.
7. System Installed capacity of distillery plant shall be designed for one plant operating at 100 % load with consistent performance and product purity.
8. Installed plants/ Auxiliaries shall be inbuilt provision to consider the peak load requirement and plant operate at lower turndown.
9. MBOP has to be designed with proper hazardous classification.
10. All necessary changes in either equipment or in piping while switching over from one product to another, to change the source and all operational flexibility, emergency & all these provision stepwise documented separately.
11. Directive and guidelines for Fire and safety measure for plant and storage area.

12. Bidder shall ensure, plant layout will be as per all statutory rules and regulation more particularly to factory inspectorate.

4.2 MECHANICAL BALANCE OF PLANT (MBOP) SHALL BE COMPLETE MORE PARTICULARLY INCLUDING ITEMS MENTIONED BELOW:

1. All equipment / Auxiliaries like water storages, Molasses storage tanks and pumps, cooling tower for fermentation, distillation, evaporation and pumps, Piping, Storage tank etc. with proper supporting, painting, insulation, labeling.
2. PRDS, Steam distribution and condensate handling, piping with proper supporting, insulation, Painting, Labeling.
3. Raw and treated Spent wash, pumps and handling Piping, Storage tank etc. with proper supporting, painting, insulation, labeling.
4. Spent lees collection & handling tank, pumps and piping
5. Compressor, accessories and piping
6. Fire water pump, piping and equipment as per Fire & Safety guidelines.
7. All by control valves, maintenance pro instrumentation shall bypass valve and isolation valve.
8. All integral piping for Process lines, steam, cooling water supply return, Process/soft water, service and instrument air, process piping, condensate ,effluent piping.
9. Instrumentation and control suitable for total operation for balance of plant through PLC of respective plant area, storage.
10. All requisite valve and proper valve selection
11. All vents to elevated at safe location
12. All drain to connected to nearby gutter.
13. All electrical power cabling from PCC to MCC & on onwards to respective driving
14. All signal and control cabling from respective section plant and storage and its equipment up to plant DCS in Bidders scope.
15. All other supporting auxiliaries and plant components required for safe, reliable and continuous year round operation for distillery.
16. All equipment will designed & manufactured as per ASME section VIII
17. All pumps will designed and manufactured as per ASME

18. All heat exchanger and re boiler will be designed as per TEMA standard
19. Suppler shall identify all critical lines, basis for critical line ensure for all lines will be safe in operation.
20. Bidder shall mention the life of the plant, resin, insulation etc.
21. Site fabrication, Erection and commissioning tool& tackles and requisite spares shall be considered by Bidder.
22. Bidder shall consider suitable Material of construction, proper composition considering fluid properties and process parameters.
23. Bidder shall furnishings all necessary engineering data /drawing, operating philosophy and trip logic for plant and if required for integration with respective section DCS system.
24. The design Material ,construction ,Manufacturing ,Inspection ,testing and performance of section of MBOP and its accessories shall comply with the requirement of applicable latest Indian Standard, Bidder shall furnish a quality assurance plan for review and approval by client/ consultant ad strictly comply with the approval quality plan.
25. Bidder shall ensure proper supporting, painting, insulation, labelling, accessibility, maintainability for equipment and instruments.
26. Bidder shall ensure proper area to be kept for man movement, piping area, staircase, ladder, flat form, railing, maintenance area bay.
27. Pipe rack shall consider all process and utility piping, load for insulation, instrument and electrical cable, mountings, loops. Painting is included in scope.
28. Yard piping and pipe rack shall consider man movement, vehicle and crane movement while road crossing.
29. Proper culverts/casing to be provided for underground piping while crossing the road, storm water drain, gutters.
30. Firefighting system shall be designed considering all fluids, material are present and to be handled in the plant.
31. Firefighting system shall be designed considering other underground piping, storm water and gutters.

4.3 BASIS FOR SELECTION MBOP

This section intends to specify the basis for the design of balance of plant (Mechanical) for Ethyl Alcohol / ENA plant based on molasses fermentation and distillation. Process and minimum essential requirement for utility and raw material handling to support for stable and consistent performance of the 30 KLPD Distillery plant for minimum 300 days every year operation.

Balance of plant (Mechanical) Auxiliaries shall be designed to support and operate the various section of plant and units from fermentation to composting.

Balance of plant (Mechanical) and Auxiliaries are in line to, operates the distillery and effluent treatment plant continuously, with highest possible product purity, yield performance and efficiency.

Balance of plant (Mechanical) Auxiliaries shall be designed to support and operate the various section of plant to operate round the clock throughout the year for minimum 300 days.

4.4 SECTION COVERS BALANCE OF PLANT (MECHANICAL) FOR DISTILLERY:

1. Molasses storage and handling
2. Cooling tower, Pump and CWS & CWR piping
3. Fire Fighting System
4. Piping and pipe rack
5. Compressor and compressed air distribution

4.5 MOLASSES HANDLING SYSTEM DESCRIPTION OF OPERATION

Molasses from sugar factory is hot from the last effect of masscuites outlet shall be discharge to molasses storage tank in sugar factory premises. The hot molasses having temperature 45 to 55° C is kept under recirculation with help of pump this helps to reduce the temperature of molasses to ambient.

This molasses is stored in steel tank and keeps on recirculation with help of recirculation cum transfer pump. Molasses tank and recirculation pump are connected and isolated in such way that it will provide the flexibility to either tank for loading ,recirculation ,transfer of molasses from tank to another and transfer to Day feed tank in fermentation house.

Considering the future provision for additional capacity and tank for molasses storage provision for pump, piping connectivity is kept so that in future it connected with new system.

4.6 MOLASSES STORAGES AND HANDLING

Sr. No	Particulars	Working Capacity	MOC	Thickness Min. (mm)	Qty. (Nos)
A-1	**Molasses Storage Section**				
1.	B-Molasses Bulk Storage Tank	5000 MT	MS IS-2062	As per API 650	1
2.	B-Molasses Bulk Storage Tank Transfer pump to day tank.	25 MT/hr.	Wetted part – SS 304	-	2
3.	Final Molasses Bulk Storage Tank	5000 MT	MS IS-2062	As per API 650	2
4.	Molasses Unloading Pit (For Procured Molasses)	25 MT	MS IS-2062	6	1
5.	Molasses loading pump to Molasses Bulk Storage Tanks	30 MT/hr.	Wetted part – SS 304	-	2
6.	Final Molasses Bulk Storage Tank Transfer pump to day tank.	25 MT/hr.	Wetted part – SS 304	-	2

DESIGN STANDARDS

Design and construction shall be in accordance with ASME, Section VIII for tanks and ASME 31.1 for process piping or equivalent Indian standards.

Molasses handling system, shall be of robust construction with structural frame in accordance with the standards stated.

Strainer shall be provided for molasses inlet line for loading pumps to avoid any foreign body enter into storage tank and transfer pump. Unloading pit shall be provided with steel grid to avoid any foreign body from outside from tanker shall not enter into system.

Proper slope for molasses unloading ramp to be provided.

4.7 COOLING TOWER

GENERAL REQUIREMENTS

1. Cooling tower shall have an in built capacity 10% more than the maximum load. Maximum heat load in respective section like fermentation, distillation and evaporation system.
2. All the shells are identical & of equal capacity is more than one shell required. Arrangement of cells are such that any cell can be taken for maintenance while others are in operation.
3. Cooling tower shall be with induced draft, counter flow design
4. Capacity Cooing tower basin shall be designed for minimum 10min. retention.
5. Bidder shall submit the performance test procedure for Purchaser / Consultant approval
6. Bidder shall indicate the minimum expected guaranteed life of fills and fan blades as called in the respective clauses and if warranted prior to the guaranteed life, the same shall be replaced free of cost to the Purchaser.
7. Commissioning consumables shall be in Bidder scope.
8. Bidder shall submit the power consumption data during normal operation of the system.
9. Recommended two years spares list along with price details shall be submitted along with the offer.

10. All necessary instruments required for testing the cooling tower shall be brought by vendor.
11. The Cooling water requirements for the Fermentation Plant are as under–

a.	Cooling water circulating flow rate	:*	To be Specified
b.	Temperature Difference (ΔT)	:	2 Degree. C
c.	Inlet /outlet water temperature	:	34 /32 °C
d.	Design wet bulb temperature	:	28 °C
e.	No. of cells	:	*
f.	Make up water	:	*

12. The Cooling water requirements for the Distillation Plant are as under

a.	Cooling water circulating flow rate	:*	To be Specified
b.	Temperature Difference (ΔT)	:	8 Degree. C
c.	Inlet /outlet water temperature	:	40 /32 °C
d.	Design wet bulb temperature	:	28 °C
e.	No. of cells	:	*
f.	Make up water	:	*

13. The Cooling water requirements for the Ethanol Plant are as under –

a.	Cooling water circulating flow rate	:*	To be Specified
	Temperature Difference (ΔT)	:	8 Degree. C
b.	Inlet /outlet water temperature	:	40 /32 °C
c.	Design wet bulb temperature	:	28 °C
d.	No. of cells	:	*
e.	Make up water	:	*

14. The Cooling water requirements for the evaporation Plant are as under-

a.	Cooling water circulating flow rate	:*	To be Specified
b.	Temperature Difference (ΔT)	:	10 Degree. C
c.	Inlet /outlet water temperature	:	42 /32 °C
d.	Design wet bulb temperature	:	28 °C
e.	No. of cells	:	*
f.	Make up water	:	*

15. Cooling Water Circulation Pumps

The pump units shall be complete with drive motor, couplings, coupling guards, speed control mechanisms, common base plates, cooling water / sealing oil / lubrication / flushing Oil piping hardness (if applicable) and any other accessories and auxiliaries required Such as foundation bolts etc.

16. Material of Construction for below pumps:

a.	Casing	:	Cast Iron
b.	Impeller	:	Stainless Steel 304
c.	Shaft	:	Stainless Steel 304
d.	Sleeve	:	Stainless Steel 304
e.	Seal	:	Gland
f.	Suction cover	:	Stainless Steel 304
g.	Coupling type	:	Tyre type / spacer type love joy

17. For Fermentation

a.	Qty.	:	2 nos.
b.	Pump Type	:	Centrifugal h/z split casing.
c.	Capacity	:	* To be Specified
d.	Head	:	25 m (final head may be changed as per head requirement)

18. For Distillation

a.	Qty.	:	2+1 nos.
b.	Pump Type	:	Centrifugal h/z split casing.
c.	Capacity	:	* To be Specified
d.	Head	:	30 m (final head may be changed as per head requirement)

19. For Ethanol

a.	Qty.	:	2 nos.
b.	Pump Type	:	Centrifugal h/z split casing.
c.	Capacity	:	* To be Specified
d.	Head	:	30 m (final head may be changed as per head requirement)

20. For Stand Alone Evaporator

a.	Qty.	:	2 nos.
b.	Pump Type	:	Centrifugal h/z split casing.

c.	Capacity	:	* To be Specified
d.	Head	:	30 m (final head may be changed as per head requirement)

**to be confirm by Bidder*

4.8 INSTRUMENT AIR COMPRESSORS SYSTEM

To supply compressed air for control drives, control valves, pneumatic tools and miscellaneous control system. For Service air two separate air compressors shall be provided. The system will provide a reliable supply of air that is free of water, oil or solid contaminants.

Air compressor package shall be skid mounted with inter and after cooler, receiver, dryer, automatic control and monitoring system

4.8.1 AIR COMPRESSORS

Qty: 2 nos. (1 WORKING 1 STANDBY)

The compressors are to be opposed, belt pulley driven, non-lubricating type reciprocating air compressors complete with drive guards, AC electric motors, etc. The heat exchangers shall be designed as per TEMA-C and coolers shall be mounted horizontally. The air receiver shall be fabricated from SA 515 Gr. 70 or IS: 2002 material. The internal surface shall be galvanised.

Each unit shall be capable of delivering approximately **200 cu.m. /hr** (measured as standard free air) of oil free air. The delivery air pressure shall be 7 kg/cm² (g)

Each compressor shall be provided with a control panel including a pressure switch, timers, pilot valve, auto/manual selector switch and changeover switch and shall be capable of communicating with the main plant control room.

Each compressor shall be driven by a TEFC electric motor through a Vee belt drive. Compressor & drive shall be mounted on a mild steel fabricated baseplate, with suitable guard for Vee belt drive & complete with foundation bolts.

The air compressor shall be provided with accessories like Intercooler, after cooler, Moisture separators, Air driers, independent Air receivers, all interconnecting pipe work & fittings and control panel

4.8.2 OTHER TECHNICAL REQUIREMENTS

Each air compressor will include the following accessories:

1. Silencer and filter for air intake
2. Inter cooler for multi-stage compressor complete with trap station with bypass arrangement.
3. After cooler complete with trap station with bypass arrangement
4. Air receiver of 2.0 m^3 (water volume) or higher capacity to hold air and minimize pressure fluctuations.
5. Instrumentation to monitor and control the whole compressed air system including pressure gauge, pressure transmitter, temperature gauge and temperature transmitter. The system shall be compatible to connect to Plant DCS in future.
6. All pipes will be ERW heavy duty, C class GI or aluminum.
7. Interconnecting valves, safety valves, NRV's and piping.
8. All valves for air will be ball valves with Teflon seating. All valves for water shall be ball valves, designed for 5 kg/cm^2 (g) pressure.
9. Automatic moisture traps at both compressors and at receiver.
10. Water for cooling will be provided at 1.5 kg/cm^2(g) to 2.5 kg/cm^2(g)
11. Cooling water will be available at 32^0C
12. The electric motor shall be as per IS 325 and compressor is driven through flat belt-pulley. Electric motor shall be of IP 54 enclosure

Air Drying Plant

One no. heatless type air drying plant of 150 m3/hr capacity or as per compressor capacity with 2 nos. drying towers with Activated Alumina as desiccant will be installed at compressor outlet for producing moisture free air of instrument air quality. Re-generation shall be done using purge air.

The material of absorber tower shall be of IS 2002 Gr. 2. The maximum air pressure drop shall be limited to 0.3 kg/cm2. The air dryer plant outlet air pressure shall be 7.0 kg/cm2g and the maximum air temperature shall be 400C. The mechanical design pressure of air drying plant shall be 10.5 kg/cm2 (g).

Air Receiver

The receiver will be self-supporting cylindrical vessel. The receivers will be so sized that in the event of a compressor failure, the receiver pressure will not fall from the normal working pressure of 7 kg/cm2 (g) to 4 kg/cm2 (g) in less than 5 minutes time.

The air receiver shall be designed as per IS 2825. Material of construction shall be IS 2002 Gr. 2 and the design pressure shall be 10.5 kg/cm2(g). Minimum capacity of the receiver will be 2 m^3.

4.8 FIRE FIGHTING & PROTECTION SYSTEM (To Be Quoted Optional / Separately)

Fire protection system to be offered based on site plan. The system is designed as per International rules (NFPA) & equivalent standards. List of Reference: NFPA-10-Standard for portable Fire Extinguishers.

- NFPA-11 –Standard for Low expansion foam system
- NFPA-13-standard for sprinkler system installation.
- NFPA-14-Standard for the installation of standpipe, Private Hydrant & Hose system.
- NFPA-15 standard for water spray system.
- NFPA-24 Private Fire Service mains &their appurtenances.
- NFPA-30 Flammable & Combustible Liquid code
- NFPA-72 National Fire Alarm Code

Fire protection system shall be provided for the above plant as per the design basis and PESO guidelines for entire Distillery Plant. Scope of work includes design, engineering, supply of equipment and components with all statutory approvals required for fire protection system for all areas as per system mentioned below. Following works are also to be included in the scope.

- Construction of firewater storage tanks
- Construction of fire pump house
- Earthing of equipment
- Erection of firefighting piping & equipment
- Firefighting system to be included fire pump house, suitable size piping and nozzles (to be common for distillery & Incineration boiler cogen and to be designed accordingly). Bidder to keep provision for piping extension with tap arrangement at suitable location (to be mutually finalized during detail engineering) for use of Incineration Cogen plant

SECTION – 5

PIPING DESIGN & VALVE REQUIREMENTS

5.1 REQUIREMENT FOR PIPING AND VALVE

PIPING

1. All steam, condensate piping and header, mountings on/in line, condensate pot will be as per applicable IBR standard,
2. All piping will be aesthetically and neatly laid on pipe rack with proper supporting, proper color coding and labeling.
3. The Plant and Process piping will include compressed air, water, drain, vent, purging etc.
4. All piping required for effectively connecting all utilities, sources, product storage, raw material feed tank.
5. The piping provided in all respect including valves, fitting, supports, special items as required. Necessary support material, towers, trestles to support and anchor the pipelines at regular span/intervals shall be supplied. Suitable expansion loops and hangers shall be provided wherever necessary.
6. Proper slope for all piping shall be maintained wherever necessary.
7. Suitable expansion loops and hangers shall be provided so as to ensure compliance with applicable codes and to limit the stress and movement, reaction to within the allowable values.
8. The flow velocities in pipelines shall be limited to be following values:

i.	Molasses	: 0.4 to 0.5 m/Sec
ii.	Steam condensate	: 2 m/Sec
iii.	Compressed air	: 20 to 25 m/Sec
iv.	Saturated steam	: 15 to 20 m/Sec.
v.	Process vapors	: 30 to 50 m/Sec.
vi.	Spent Wash	: 1.6 m/Sec.

9. Pipe rack with service platform where is necessary shall consider all process and utility piping, load for insulation, instrument and electrical cable, mountings, loops.
10. Yard piping and pipe rack shall consider man movement, vehicle and crane movement while road crossing and have service platform.
11. Proper culverts/casing to be provided for underground piping while crossing the road, storm water drain, gutters.
12. Firefighting system shall be designed considering all fluids, material are present and to be handled in the plant.
13. Firefighting system shall be designed considering other underground piping, storm water and gutters.

5.2 Valve Selection and MOC

Sr. No.	Fluid	For 50 NB & Below	More than 50 NB
1	Molasses	Flanged end type Ball valve contact part SS 304	Gear operated Butter fly valve, CI Body and Contact part SS304
2	Fermented Wash	Flanged end type Ball valve contact part SS 304	Gear operated Butter fly valve CI with Neoprene, SS 304 internals
3	Process & cooling water –	Flanged end type Ball valve CS/CI body	Gear operated Butter fly valve CI body & SGI disc.
4	CO2:		Gear operated Butterfly valve with CI body and SS 304 disc
5	Air	Flanged end type Ball Valve with contact part SS304 A & body Cs.	
6	Spent wash	Flanged end type Ball valve with SS304 contact	Gear operated Butterfly valve with CI body and SS 304 disc
7	AA	Flanged end type Ball valve with SS304 contact	Gear operated Butterfly valve with CI body and SS 304 disc
8	Spent lees	Flanged end type Ball valve with SS304 contact	Gear operated Butterfly valve with CI body and SS 304 disc
9	Steam condensate	Flanged end type Gate valve with CI body	Flanged end type Gate valve with CI body
10	Steam	Flanged end type Globe valve as per IBR	Flanged end type Gate valve as per IBR

SECTION – 6

INPUTS FOR CIVIL & STRUCTURAL CONSTRUCTIONS

6.1 MAJOR CIVIL WORKS

Bidder to provide all required inputs including load data, drawings and layouts as inputs for designing the civil works for all plant & equipment in his scope. Design and construction of civil works will be done by Purchaser.

a. Foundations for distillation process columns, structural columns, etc.

b. Foundations for auxiliary cooling systems

c. Foundations for fermenters & evaporator

d. Firefighting facilities including sheds for fire tenders, foundations for firefighting equipment, pipe lines for firefighting/fire hydrants etc. and other auxiliary buildings

e. Foundations for large tanks including raw material, finish product, waste water treatment plant, WTP, pumps, PHE, pipe racks, electrical equipment, pipe / cable racks, etc.

f. Panel rooms, sheds for equipment

g. Provisions for street lighting, yard lighting, area lighting etc. within battery limits.

h. Drainage channels, storm water drains

i. Earthing pits and earthing mats in EPC bidder scope.

SECTION – 7

PROCESS/PERFORMANCE GUARANTEE PARAMETERS

7.1 CAPACITY: 30 KLPD Ethanol @ 99.8% v/v or ENA @ 96.2% v/v

Sr. No	Product	Production Liters/Day	Speciation v/v % Alcohol
1	Rectified spirit	(Minimum) 30, 000	95
2	Extra Neutral Alcohol	(Minimum) 30, 000	96.2
3	Impure spirit	(Maximum) 1500	94.68
4	Ethanol	(Minimum) 30, 000	99.8

7.2 ALCOHOL YIELD PER MT OF MOLASSES AND ALCOHOL CONCENTRATION

Sr. No	Fermentable Sugar	Yield Liter/ MT of molasses	Alcohol concentration in Fermented wash V/V
1	40%	240	8.50 (Min.)
2	42%	252	9.50 (Min.)
3	44%	264	11.00 (Min.)
4	46%	276	12.00 (Min.)

Bidder shall submit the process guarantee for all A, B, & C grade molasses as per above mentioned table.

7.3 FERMENTATION EFFICIENCY: Minimum 91 %

7.4 DISTILLATION EFFICIENCY: Minimum 98.5 %

7.5 TURN DOWN FOR CAPACITY: To be confirmed by Bidder

7.6 STEAM CONSUMPTION AT 3.5 KG/CM2 (G)

SR. NO	Product /Area	Steam Consumption Kg/Lit
1	Wash to Rectified sprit : 95 % v/v	Not more than 1.80
2	Wash to ENA : 96.2 % v/v	Not more than 3.20
3	De hydration 99.8 % V/V	Not more than 0.55
4	Stand Alone Evaporation	Not more than 2.20

7.7 SECTION WISE POWER CONSUMPTION

SR. NO	Section	Operating Load	Connected Load
1	Fermentation section	*To be Specified	*To be Specified
2	Distillation section (RS/ENA)		
3	Dehydration		
4	Standalone Evaporation		
5	Molasses storage		
6	Alcohol storage		
7	CPU		
8	Cooling tower area a. Fermentation b. Distillation c. De hydration d. Evaporation		
9	Raw water/Soft Water/DM water		

Note: Bidders to provide section wise power breakup

7.8 COOLING WATER CIRCULATION RATE:

SR. NO	Section	M3/ Hr	Delta T ^{O}C
1	Fermentation plant		
2	Distillation section		
3	Ethanol section		
4	Evaporation		

7.9 COOLING TOWER BLOW DOWN & MAKE UP WATER

SR. NO	Section	Blow down M3/ Day	Make up water requirement M3/ Day
1	Fermentation plant		
2	Distillation section		
3	Ethanol section		
4	Evaporation (Water to vapour ratio to be confirmed by bidder)		

7.10 PROCESS WATER: ----------M3/Day

7.11 SOFT WATER (Fresh start up and without recycle):---------- M3/Day

7.12 SOFT WATER (With recycle):--------- M3/Day

7.13 CONSUMPTION OF NUTRIENT AND CHEMICAL

1	Urea	
2	Sulphuric Acid	
3	DAP	
4	Anti-foam solution	
5	Enzymes	
6	Water treatment chemicals	

7.14 CHEMICAL FOR CLEANING (For CIP System)

1	Caustic Soda	
2	Nitric Acid	
3	Sulphamic Acid	
4	Wetting agent	

7.16 PRODUCT COMPOSITION:

Indian Standard Specifications for Rectified Spirit (IS: 323)

Sr. No	Characteristics	IS Standard
1	Specific gravity at 15.6^0 / 15.6^0 C	0.8171
2	Ethanol content % by Volume at 15^0 C Min	94-96
3	Miscibility with water	Miscible
4	Alkalinity	Nil
5	Acidity (as acetic acid) % by Wt. Max	0.002
6	Residue on Evaporation % by Wt. Max	0.005
7	Aldehyde Content (as CH3CHO) gm/100ml Max	0.006
8	Copper (as Cu g/100ml) Max	0.0004
9	Methyl Alcohol Mg/Ltr. Max	To satisfy the requirement of test
10	Lead as pb, gm/100 ml. Max	0.0001
11	Fusel oil content	To satisfy the requirement of test
12	Furfural content	To satisfy the requirement of test
13	Appearance	Crystal Clear & Bright

Indian Standard Specifications for Extra Neutral Alcohol (IS: 6613)

Sr. No	Characteristics	IS Standard
1	Specific gravity at 20^0 / 20^0 C	0.8069
2	Ethanol content % by Volume at 15^0 C Min	96.00 Min
3	Miscibility with water	Miscible
4	Alkalinity	Nil
5	Acidity (as acetic acid), gm/100ml Max	1.50
6	Residue on Evaporation, gm/100ml Max	1.50
7	Aldehyde Content (as CH_3CHO) gm/100ml Max	0.0005
8	Ester as $CH_3COOC_2H_5$, gm/100 ml, Max.	1.30
9	Copper (as Cu g/100ml) Max	0.002
10	Methyl Alcohol g/100 ml. Max	5.00

Sr. No	Characteristics	IS Standard
11	Lead as pb, gm/100 ml. Max	0.10
12	Higher alcohol as Iso-amyl alcohol, gm/100 ml, Max.	30.00
13	Furfural content	Not Detectable
14	Appearance	Crystal Clear & Bright
15	Permanganate Reaction Time, Minutes	50 (Min.)

Indian Standard Specifications for Ethanol (IS: 321-1964)

Sr. No	Characteristics	IS Standard
1	Specific gravity at 15.6^0 / 15.6^0 C	0.7961
2	Ethanol content % by Volume at 15^0 C Min	99.5
3	Miscibility with water	Miscible
4	Alkalinity	Nil
5	Acidity (as acetic acid) gm/100 ml Max	0.006
6	Residue on Evaporation % by Wt.Max	0.005
7	Aldehyde Content (as CH3CHO) gm/100ml Max	0.10
8	Copper (as Cu g/100ml) Max	0.0004
9	Conductivity us /m, Max	300
10	MEthyl Alcohol / ENA Mg/Ltr.Max	300
11	Appearance	Crystal Clear & Bright
12	Denaturant as DEP 1%	--
13	Strength	74.2

7.17 EFFLUENT GENERATED: SPENT WASH * BY BIDDER

Sr. No	Parameter	Value
1	Flow rate	*
2	Temperature	*
3	PH	*
4	Solid concentration	*
5	COD	*
6	BOD	*

7.18 EFFLUENT GENERATED: SPENT LEES * BY BIDDER

Sr. No	Parameter	Value
1	Flow rate	*
2	Temperature	*
3	PH	*
4	Solid concentration	*
5	COD	*
6	BOD	*

7.19 Cooling water circulation rate for bulk storage area: ----------m3/Hr

7.20 Spent wash after integrated evaporation: ----------M3/Day

7.21 Spent wash feed to Multiple effect evaporation: ----------M3/Day

7.22 Concentrated spent wash: ----------M3/ Day

7.23 Process condensate generated: ----------M3/Day

7.24 PROCESS CONDENSATE DETAILS FROM EVAPORATION PLANT OF BOTH STAGES OF EVAPORATORS

Sr. No	Parameter	Value
1	Flow rate	*
2	Temperature	*
3	PH	*
4	Solid concentration	*
5	COD	*
6	BOD	*

7.25 SPENT WASH SOLID CONCENTRATION

Sr. No.	Location /Steam	Solid concentration % w/w
1	Intel to distillation	*
2	After distillation	*
3	Inlet to integrated evaporation	*
4	Outlet of integrated evaporation	*
5	Inlet to standalone evaporation	*
6	Outlet of standalone evaporation	*

7.26 STEAM CONDENSATE GENERATED:-

Sr. No	Section	Flow rate m3/Hr	Pressure kg/cm2 (g)	Temperature Oc
1	Distillation			
2	De hydration			
3	Evaporation			

7.27 Evaporation Cycle Time (without cleaning): To be confirmed by Bidder

7.28 Turn Down for plant Capacity:

1. **Distillation : To be confirmed**
2. **Integrated evaporation : To be confirmed**
3. **Standalone evaporation : To be confirmed**

SECTION – 8

DOCUMENTS & DRAWINGS LIST

8.1 DOCUMENTS AND DRAWING LIST

The suppler shall provide all engineering drawings, documentation during contract period at respective time of project life cycle for submission, approvals & record, total six set along with all soft copies of all detailed technical documents, drawings, complete with all technical information, data sheet, commissioning protocol, operation manual ,maintenance manual, spare part catalog, with vendor contact detail with all general information etc. in respect of supply, more particularly following, Bidder shall provide separate schedule for engineering documentation submission along with the project schedule.

8.2 BASIC PROCESS DESIGN: (Bidders to be provided along with quotation)

1. Process description
2. Design basis including water balance, mass balance, power balance etc.
3. Fluid category index and Basic Material of construction
4. HAZOP Study report
5. Line sizing and pressure drop calculation
6. Section wise PID
7. Preliminary equipment layout and elevation
8. Equipment list
9. Process control and instrumentation logic
10. Instrument list
11. Thermal Design for re-boiler, heat exchanger and cooler.
12. Pump hydraulics, pump data sheet
13. Equipment data sheet

8.3 DETAIL ENGINEERING

1. Piping Design
2. Design Basis
3. Line list
4. Critical line list with basis and stress analysis
5. Thickness calculation
6. Piping material specification
7. Equipment layout and elevation including support, staging & platforms etc.
8. Piping plans at various level
9. Isometric drawing
10. Piping support standard
11. Pipe supports
12. Special item list with all detail specification
13. Terminal point list with condition
14. Civil load data
15. Foundation load data
16. Valve list and valve data sheet
17. Stress analysis and/ or Finite element analysis wherever applicable.

8.4 MECHANICAL DESIGN

The Bidder shall provide all technical information including operating & maintenance manuals and spare parts catalogues with all general information brochure, leaflets, etc. in respect of all items of supply, including followings:

1. Design basis
2. Thickness calculation
3. Equipment General arrangement drawing
4. fabrication drawings
5. Equipment support arrangement
6. Nozzle orientation
7. Civil load data

8.5 ELECTRICAL

The Bidder shall provide all technical information including maintenance manuals and spare parts catalogues with all general information brochure, leaflets, etc. in respect of all items of supply, including following:

1. Basis
2. Single line diagram
3. PCC/MCC panel GA
4. PCC/MCC panel internal specification
5. Cable specification
6. Cable routing layout
7. List of motor with all details
8. MCC panel charging producer

8.6 INSTRUMENTATION

The Bidder shall provide all technical information including maintenance manuals and spare parts catalogues with all general information brochure, leaflets, etc. in respect of all items of supply, including followings:

1. List of documents & document submission schedule with document nos.
2. Instrumentation design basis.
3. Quality Assurance procedure.
4. Instrument index specifying the tag wise details of individual instrument,
5. Location service, type of signal, P&ID no. Line no or equipment no. make model no. as a minimum.
6. Write up and control logic diagram.
7. Control Narrative and interlock description.
8. Technical specifications and data sheets of all the field instruments with all ordering information.
9. Technical specifications for DCS based control system with all the ordering information.
10. System Architecture of DCS
11. General arrangement drawings for all the field instruments.
12. Terminals details of all the field instruments.
13. Instrument cable tray routing drawing.

14. Instrument location and elevation drawings.
15. Instrument cable schedule and junction box schedules.
16. All factory test certificates and calibrations certificates.
17. Calculations and sizing details for Orifice flow meters, control valves, magnetic flow meters etc.
18. Field instrument calibration reports.
19. List of commissioning spares.
20. List of 2 years operational spares.
21. DCS panel control wiring diagram, power wiring diagram
22. Final DCS software back up.
23. UPS sizing calculations & drawings/ documents

8.7 ERECTION, COMMISSIONING AND MAINTENANCE

1. Erection Protocol
2. Pre commissioning check list
3. Commissioning protocol
4. Six sets of Operation Manual
5. Six sets of Maintenance manual
6. Six sets of final as built drawings.

8.8 QUALITY ASSURANCE PROCEDURE,

1. Engineering and documentation
2. Procurement process
3. Manufacturing process
4. Welding procedure
5. Site fabrication
6. Installation of plant, machinery & piping
7. Project management, site supervision
8. Water trails, Hydro testing, blowing, Pre commissioning & commissioning

8.9 FORCES AND MOVEMENT DIAGRAM FOR ALL MATING POINTS.

Terminal point list, with Pressure temperature condition, coordinate and with all required information

8.9.1 All test certificate

8.9.2 As built drawing for all mentioned documents.

8.9.3 IBR folder for all pipe lines, equipment, and pressure part comes under IBR preview.

SECTION - 9

APPROVED MAKES, CRITICAL COMPONENTS

9.1 Approved Makes of Critical Components

A) A typical standard preferred list of vendors for main distillery plant is provided below.

S. No.	Description	Make
A.	**Mechanical**	
1	Centrifugal Pump for water	Grundfoss / KSB/Flowserve/Mather & Platt/KBL
2	Progressing Cavity pump	Rover / Roto/ Risani/ Rotmac/ Hydroprokav
3	Alcohol, spent wash / lees, fermented wash pump	Micro finish/KSB/Flowserve
4	Air compressor lubricated	Ingersoll Rand /Atlas Copco /Elgi
5	Plate Heat Exchanger	Alfa Laval/Kelvion
6	Cooling towers	Paharpur / Wet Bulb
7.	Air Blower / Vacuum pump	PPI / TMVT
8	Weighing Scale -	Avery / Nova Weigh/Percia Molen
9	Gear Box	Flender / Triveni / Greaves/Raicon
10	Expansion Joint	
	Metallic Joint (Others)	Metallic Bellows / Flexotherm / GBM / Fluidyne Engineers / Lonestar Industries / Flexican Bellows / Pepiflex
11	Geared Motors	International Combustion India Ltd. / PBL / Bonfiglioli / Crompton Greaves Ltd
12	Couplings	Fenner / Love Joy / GBM /Resoflex / Utkarsh
13	Bearings	SKF / FAG /NTN
14	Direct Water Level Gauge	
	Tubular Type	WJ NETA / Levcon / Chemtrol /Asian / R.K.Dutt
	Transparent	Levcon / Chemtrol /Asian / R.K.Dutt

S. No.	Description	Make
15	Insulation	
	LRB	Min Wool / Rock Wool Industries / Lloyd Rock Fibres / Rockwool (I) Ltd
	Aluminum Cladding	BALCO /INDALCO / HINDALCO
14	Traps	J.N. Marshall / Pennant / Greaves Cotton
15	Spring Hangers	Sarathi Engg / Pipe Supports
16	Orifice Plates	Micro precision / Hydro pneumatics / Fairflow / IL / General instruments / Gurunanak / Placa
17	Flow Nozzles	Microprecision / Engineering Specialties - Kolkata / Instrumentation Ltd, Palakkad / General Instruments
18.	Metallic Bellows	Flexicon / Lone Star / Metallic Bellows / Instrumentation Ltd. / Cori Rubber
19	Motors	Crompton/ABB/Siemens
20	Molecular Sieves	Zeochem / Ceca
21.	Diesel Pump	Kirloskar / Cooper Corp
22	MS Plate	Tata / SAIL / Jindal
23	SS Plate/Coil	Jindal
24	Structure	Tata
B.	**Valves**	
1.	Control Valves	Samson/ Dresser / Fisher Xomox / Dembla/Forbes Marshall
2.	Safety Valves	BHEL / TYCO SANMAR / FAINGER LEASLER
3.	Solenoid Valves	Avcon / Asco / Rotex / Veljan / El-Omtic / Nucon
4.	Solenoid Operated Ball & Butterfly Valves	El-O-Matic / Rotex /Virgo
5.	Solenoid Gangs	Avcon / Nucon / Rotex
6.	Ball Valves	BDK /Micro Finish // Rotex / Flow Jet / Audco
7.	Valves - Ball (Screwed)	GM / Unison
8.	Valves – Butterfly	Tyco-Keystone / Crane /Virgo/Inter Valve
9.	Valves - Gate/ Globe/NRV	Arem / Steel Storng / Expert /Flowjet / Calson

S. No.	Description	Make
10.	Vacuum Relief Valve	KSB / BHEL / Audco
11.	Pressure reducing valve	Forbes Marshall/Mazda
C.	**Electricals**	
1	LT Bus Duct	Enpro / Elpro /C&S / L&T & equivalent
2	HT Switch Gear	ABB / Siemens /Schneider & equivalent
3	LT PCC / MCC	CPRI approved
4	Energy Meter	MECO / AE /IMP / Enercon / Easunrexrolle
5	Motors	Crompton / ABB / Siemens / Kirloskar
6	Power & Control Cables	Finolex /Polycab/Incab & equivalent
7	Air Circuit Breakers	L&T / Siemens/ GEC /ABB & equivalent
8	Fuse	L&T / Siemens/ EE / BCH /ABB
9	Switches	L&T / Siemens/ BCH /ABB & equivalent
10	Switch/Fuse Unit	L&T / Siemens/ BCH /ABB & equivalent
11	Thermal Overload Relays	L&T / Siemens/ ABB & equivalent
12	Contactors	L&T / Siemens/ BCH / ABB & equivalent
13	Ammeter/Volt Meter	AE / Meco / Rishab / Enercon & equivalent
14	Push Buttons	Siemens / Teknik & equivalent
14	Control Transformer	Kappa Consolidated / Rowsons / Cortina
15	Selector Switch	Salzer / Kaycee & equivalent
16	Indicating Lamps	Siemens / Tecnic & equivalent
17	MCB	MDS / Indo Asian / Siemens & equivalent
18	Terminal Blocks	Elmex / Jainson / IML & equivalent
19	MCCB	L&T / E.E / Siemens /ABB /Schneider
20	Timer	L&T / E.E / Siemens & equivalent
21	Cable Glands	Cabend / Baliga / Comet / Exprotecta
22	Air Conditioning	Carrier Aircon Ltd / Blue Star Ltd / LG / LLoyed Electronics
23	Battery & Battery Charger	Amara Raja / Exide / Amaron & equivalent

S. No.	Description	Make
24	Lighting Material Flameproof	Philips / Bajaj / GE / Crompton Greaves
25	UPS	Emerson / Numeric /Hirel
	INSTRUMENTS	
26	**DCS**	ABB / Yokogawa / Honeywell / Emerson / SIEMENS
27	SMART Transmitters	Yokogawa / Emerson / Honeywell / E & H/
28	Temperature Gauges / Sensors	H.Guru / Waree Instruments / Forbes Marshall/ Radix Micro System / Radic SensorI/Wika
29	Pressure Gauges	H. Guru / Waaree Instruments / Forbes Marshall / Radix Micro System / Radic Sensor
30	Thermo Couples	Nutech Engineers / Tempsons / Thermal Instruments
31	Pressure Switch / Temperature Switch	Switzer / Indfoss
D.	Level Switch (Float Type)	Levcon / Chemtrol
1	Limit Switch	Pneumatic Controls / Jai Bajaj / BCH / Siemens / Honeywell
2	Transducers	Elster / Meco / Masibus / Rishabh
3	Transmitters	Rosemount / Siemens /ABB / YBL / SMAR/Emerson
	Contactless Level Transmitter	Yokogava / Emerson / E&H
4	Auto Manual Loader	Micromax / Masibus
5	I/P Convertors	ABB / C G Hartman & Braun / Moore
6	Digital Indicator	Teletherm / MCIH / Masibus
7	Air Filter Cum Regulator	Placka / Veljan / Shavo

S. No.	Description	Make
8	Compensating Cables	Thermopads / Associated / Cords / Technocab/Polycab/Icon
9	Magnetic flow meters	Rosemount /Forbes / E & H / Yokogawa / Samar
10	Flow meter Rota meters	Bernoulli's / Eureka / Spinks Controls
11	PRS & PRDS	Forbes Marshall- Area / Samson
13	Actuated Control Valves	Virgo/Tyco /Cranes / Delval / Crone / Dembla / Bray /Air Power

SECTION – 10

TERMINAL POINTS

10.1 MECHANICAL

Nutrient	At the inlet of Nutrient dosing tank
Anti-foam solution	At the Inlet of Anti foam solution tank
Sulfuric Acid	At the inlet of Sulfuric Acid tank
Caustic	At the inlet flange of CIP Tank in respective area
Molasses from outside	At Inlet of molasses unloading pit
Cane Juice/Syrup	Purchaser shall be provided at the inlet flange of Intermediate storage tank located in proposed distillery section
B-Molasses	Purchaser shall be provided at the inlet flange of B-molasses Bulk storage tank located in proposed distillery section
Final Molasses	Purchaser shall be provided at the inlet flange of B-molasses Bulk storage tank located in proposed distillery section
Raw water/Clarified Water/Soft Water/DM water	Bidder has to take the water from proposed water treatment plant located at existing Sugar WTP plant (approx. 150 M distance) including pumps & piping
Steam @ 3.5 Kg/cm2(g) & 148 ^{0}C	From distillery steam distribution header (to be provided by Distillery Bidder with required capacity and nozzles) and further distribution of steam to each sections .wherever applicable has to consider PRV in the scope of supply.
Steam @ 1.5 Kg/cm2(g) & 120 ^{0}C	Bidder to be taken from distillery steam header with providing suitable PRV
Steam Return Condensate	At the outlet flange of steam condensate transfer pump including pumps at one common point
Safety valve exhaust	Outside of plant building at safe location and elevation
Vent	Outside of plant building at safe location and elevation
Drains if any	At the inlet of common pit located at proposed CPU Unit

Concentrated Spent wash from standalone evaporation	Bidder has to provide the slop @ temperature of the minimum 70 Deg C at the inlet of slop/ feed tank located in slop fired incineration boiler, with required steam heating or blowing arrangement (Slop/ Feed tank in Incineration Boiler scope)
Process Condensate & Spent lees	At the inlet of CPU equalization tank
Treated Water from CPU	CPU bidder will provide at the nearest point of fermentation section. Distillery bidder will do the further connections to respective locations
Rectified sprit/ENA /SDS loading	At the outlet of PD flow meter with providing flexible food grade SS 304 hose of min. 5 meter length
Ethanol loading	At the outlet of PD flow meter with providing flexible food grade SS 304 hose of min. 5 meter length
Impure Sprit loading	At the outlet of PD flow meter with providing flexible food grade SS 304 hose of min. 5 meter length

10.2 INSTRUMENTATION

Instrument Air	Entire Instrument Air including compressor & receiver / dryer will be in Bidder scope
Instrumentation/DCS & Cabling	Entirely in EPC Bidder's scope

10.3 STRUCTURAL BY BIDDER

Structural from RCC footings, ladders, platforms, supports and foundation bolts & required templates for the same, insert plates to be in bidder scope.
Purchaser will provide only RCC footings and entire distillery / ethanol plant will be on own steel structures.

Equipment support	Included
Piping support, cable trays supporting	Included
Proper platform, Staircase/ladder and railing for operation, maintenance	Included

10.4 ELECTRICAL:

At the incomer of Distillery PCC panel (PCC Panel of adequate size and further distribution to individual MCCs and thereafter included in Bidders scope).

10.5 Earthings :

Entirely in bidders scope within terminal points. Earth pits will be provided by Purchaser

10.6 Illuminations / Lighting / Lightening :

Entirely in bidders scope within terminal points. Outdoor lighting along the building periphery is in bidders scope

SECTION – 11

IMPLEMENTATION SCHEDULE

11.1 PROVISIONAL MASTER

A Provisional Master Schedule which contains a limited number of activities included.

11.2 DETAILED MASTER SCHEDULE

Within 30 days of the Commencement Date under the General & Special Conditions of Contract, the Bidder shall provide the Detailed Master Schedule (in Primavera) which shall contain:

1. Construction Schedule
2. Manufacturing Schedule
3. Mobilization Schedule
4. Drawing Schedule indicating drawings to be produced, schedule of drawing production and approvals
5. Inspection Schedules
6. Overall Integrated Master Schedule
7. Billing breakup & billing schedule

11.3 SCHEDULE UPDATES

The schedules within the Master Schedule will be updated on a monthly basis in accordance with the monthly progress meetings.

11.4 CONSTRUCTION SCHEDULE

The Construction Schedule shall contain the following

1. A detailed bar chart of the work program for each subsection of the Construction including civil works and erection of steelwork and equipment

2. A critical path plan showing critical areas, start, finish dates and floats
3. Resource Plan
   Showing all Construction Equipment, Labour and Materials to be used in accordance with the Construction Schedule.

11.5 MOBILIZATION SCHEDULE

The mobilization Schedule shall contain

1. A detailed bar chart of the mobilization program for erection
2. A program of camp construction
3. Resources to be used in mobilization
4. Manufacturing Schedule

   The Manufacturing Schedule shall contain

   a) A breakdown of each section of the equipment into its mechanical/electrical components
   b) An estimated detailed manufacturing Schedule
   c) A critical path delivery schedule showing key items.

11.6 DESIGN / DRAWING SCHEDULE

The Design/Drawing Schedule shall contain:

1. Release of load data for Civil Works
2. Preliminary Site Plan
3. Design Schedule related to construction identifying critical area.
4. Process, Mechanical and Electrical Designs
5. Schedules of Submissions and Approvals
6. Inspection Schedule
7. Integrated Master Schedule

   The Integrated Master Schedule shall contain

   a. An overall bar chart of Contract Activities
   b. Critical path plan showing critical areas, start and finish dates and floats.