

Appendix D

Vendor Information

Vendor-supplied emission rates for PM and VOC.

Source: Original table provided in diagram “2572A-PME-03-9901B_EMISSION POINTS.pdf”

Updated table reflecting dry hammer mill/pellet cooler PM emissions from email from Brandon Henderson (PNWRE) to Ed Warner (ESA) on July 6, 2023, Subject: RE: Modeled PM Impacts

PROCESS LINE	EMISSION POINT	DESCRIPTION	FILTERING DEVICE	LINE CAPACITY	EMISSION POINT HEIGHT		STACK DIAMETER		TEMPERATURE		ACTUAL FLOW RATE	NOMINAL FLOW RATE	WORKING HOURS	PM to environment after Filtering Device (NOMINAL)			VOCs estimation based on previous projects to environment after Filtering Device (NOMINAL)		
					ODST/y	m	ft	mm	in	°C				°F	m3/h	Nm3/h	h/y	mg/Nm3	ton/y
PELLET PLANT																			
GROUND CHIPS CLEANING LINE	EP-01	Sand and stones cleaning line	Cyclone	227.211	15	50	1.200	47	10	50	64.000	61.740	8.000	50	24,70	27,23	-	-	-
	EP-02	Wet hammer mill 1 pneumatic system	Cyclone	101.433	15	50	600	24	10	50	18.000	17.364	8.000	50	6,95	7,66	-	-	-
WET MILLING LINE	EP-03	Wet hammer mill 2 pneumatic system	Cyclone	101.433	15	50	600	24	10	50	18.000	17.364	8.000	50	6,95	7,66	-	-	-
DRYING LINE	EP-04	Drum dryer	Cyclone + WESP + RTO	405.733	27	90	2.200	87	55	131	210.730	175.410	8.000	20	28,07	30,94	17	23,86	26,30
DRY INTERMEDIATE STORAGE	EP-05	Dry product intermediate storage	Filter	-	13	44	No Stack		10	50	1.500	1.447	8.000	5	0,06	0,06	-	-	-
	EP-06	Dry product intermediate storage	Filter	-	13	44	No Stack		10	50	1.500	1.447	8.000	5	0,06	0,06	-	-	-
DRY MILLING AND PELLETING LINE	EP-08	Dry hammer mill 1,2,3&4 pneumatic system Pellet cooler 1&2 pneumatic system	Cyclofilter/Cyclone + RTO/RCO	417.905	27	90	2.100	83	101	214	232.278	169.576	7.500	5	6,36	7,01	23	29,25	32,25
SAWDUST INTERMEDIATE STORAGE	EP-09	Milled dry product intermediate storage	Filter	-	11	36	No Stack		10	50	1.500	1.447	7.500	5	0,05	0,06	-	-	-
	EP-10	Silo air renovation system. 6 extractors per silo	Extractor	-	28	93	No Stack		10	50	27.540	26.567	8.000	15	3,19	3,51	-	-	-
	EP-11	Silo air renovation system. 6 extractors per silo	Extractor	-	28	93	No Stack		10	50	27.540	26.567	8.000	15	3,19	3,51	-	-	-
PELLET SILOS	EP-12	Silo air renovation system. 6 extractors per silo	Extractor	-	28	93	No Stack		10	50	27.540	26.567	8.000	15	3,19	3,51	-	-	-
	EP-13	Silo air renovation system. 6 extractors per silo	Extractor	-	28	93	No Stack		10	50	27.540	26.567	8.000	15	3,19	3,51	-	-	-
	EP-14	Silo air renovation system. 6 extractors per silo	Extractor	-	28	93	No Stack		10	50	27.540	26.567	8.000	15	3,19	3,51	-	-	-

From: [Antonio Torrubia](#)
To: [Brandon Henderson](#); [Alberto Muela](#); [Forcus Martínez](#)
Cc: [Kim Alexander](#); [Mark Boivin](#); [Illya Kobzey](#)
Subject: RE: Air Emissions Questions
Date: Friday, June 23, 2023 6:00:56 AM
Attachments: [image001.png](#)
[image002.png](#)

Hi Brandon,

The only points with NOx and CO emissions are those where there is combustion. Therefore, points EP04 and EP-08.

These would be the preliminary data that we can give at this time:

EP04 – DRYING LINE:

Carbon Monoxide (CO) (lbs/hr): ≤42 lbs/hr

Nitrogen Oxide (NOx) (lbs/hr): ≤52 lbs/hr

EP08 – DRY MILLING AND PELLETING LINE:

Carbon Monoxide (CO) (lbs/hr): ≤16 lbs/hr

Nitrogen Oxide (NOx) (lbs/hr): ≤5 lbs/hr

Note: NOx emissions for Dryer Island are based on fuel nitrogen level at 0.22% bone dry basis. Higher nitrogen content within fuel will result in higher NOx emissions.

We will include this data in the drawing table and we will send it to you updated as soon as possible.

Regarding the cyclone filters, they are equipment that incorporate a bag filter, in order to reduce PM emissions up to 5 mg/Nm³.

We are still studying the final design and selecting the supplier. As soon as we have selected it, we will send the vendor documentation.

It is a very common equipment in our plants, we can send documentation of another project if you need it urgently but it may not correspond to the final vendor.

Un saludo / Best regards,

Antonio Torrubia

R+D+i Manager

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De: Brandon Henderson <bhenderson@pnwrenewable.com>

Enviado el: jueves, 22 de junio de 2023 19:21

Para: Alberto Muela <amuela@prodesa.net>; Antonio Torrubia <atorrubia@prodesa.net>; Forcus Martínez <fmartinez@prodesa.net>

CC: Kim Alexander <kalexander@pnwrenewable.com>; Mark Boivin <mboivin@pnwrenewable.com>

Asunto: Air Emissions Questions

Importancia: Alta

Alberto,

Can we add NOx and CO rate emission's to chart? We're need to include those in our Air Permit.

Also, we need clarification on the cyclone filter. Is it a traditional cyclone or will it have an actual filter in the system like a baghouse.

We also would like to have the vendor documentation to attach to our air permit application. The state is used to seeing that in the applications.

Regards,

Brandon Henderson
Director of Engineering
Pacific Northwest Renewable Energy
M: (254) 813-3260

Offer number:

2572	OFS	05	0007
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Date:

06/14/2021

To: Philip Heasman - CEO

Company: PNWRE

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Dear Sirs, please find enclosed our offer for the following products / services:

REQUESTED PRODUCTS/ SERVICES	Supply of a wood pellets production plant
DELIVERY TIME	To be checked inside
PRICE	To be checked inside
METHOD OF PAYMENT	To be checked inside
OFFER VALIDITY	To be checked inside
NOTES	General Conditions of Sales according to attached ANNEX 1

In case of accepting the conditions exposed in this offer, please send us back this document properly signed as a sign of acceptance. If you wish, you can use your own document.

I agree to receive commercial communications from Prodesa by email.

From PRODESA NORTH AMERICA

Name and position:

ACCEPTANCE by client

Name and position:

The data furnished will be processed by PRODESA MEDIOAMBIENTE S.L. with CIF B50811074, registered office at Avda Diagonal Plaza 30, Plaza Center 20 Building, 3rd Floor, 50197 Zaragoza (ZARAGOZA). The objective of the data treatment is to make the requested budget and manage a possible business relationship. The data will be kept as long as the commercial relationship is maintained or for the legally necessary time. The legal basis for this treatment is the pre-contractual relationship. The data will not be disclosed to third parties, except legal obligation. You can request your rights of access, rectification, deletion, limitation, portability and opposition by sending an e-mail to lpd@prodesa.net or a letter to the postal address indicated above, attaching a copy of the ID card and indicating the requested right. You can also submit a claim to the Spanish Data Protection Agency.

PRELIMINARY OFFER

PNWRE

WOOD PELLETS PRODUCTION PLANT



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2. INTRODUCTION

This offer has been prepared according to the request of **PNWRE** for the supply of a wood pellets production plant.

The design data that have been considered for this budget offer are the following:

EMPLACEMENT			
State	Washington, USA	City	Hoquiam, Grays Harbor County
Site coordinates	46° 58' 34 " N; 123° 54' 58" W (Corner of Airport Way & Paulson Rd – Port of Grays Harbor)		

SITE CONDITIONS			
	Minimum	Average	Maximum
Ambient temperature	14 ° F / -10 °C	51 ° F / 10 °C	89 ° F / 31 °C
Relative humidity	85 - 90%	Site elevation (o.s.l.)	18 ft – 5.5 m
Wind load	48 psf - 235 kg/m ² ; (135 mph - 60 m/s)	Snow load	25 psf - 122 kg/m ²
Seismic load	Ss = 1.532; S1 = 0.712; TL = 16; Sds = 1.225; PGA = 0.734		

ELECTRICAL DATA			
Voltage supply	460 Vac 24 Vdc	Frequency	60 Hz

INPUT MATERIAL:

RAW MATERIAL SPECIES (FOREST RESIDUALS) – GENERAL PROCESS				
Type	Softwood		Hardwood	
Proportion (%)	80 - 90%		10 - 20%	
Species	Douglas Fir:	37.04%	Red Alder:	10.41%
	W Hemlock:	42.74%	Big Leaf Maple:	1.44%
	W Red Cedar:	3.00%	Black Cottonwood:	0.29%
	Sitka Spruce:	3.07%	Bitter Cherry:	0.02%
	Pacific Silver Fir:	1.40%	Oregon Ash:	0.01%
	Lodgepole Pine:	0.43%		
	Western White Pine:	0.04%		
	TOTAL:	87.72%	TOTAL:	12.17%

RAW MATERIAL SPECIES (MILL RESIDUALS) – GENERAL PROCESS				
Type	Softwood		Hardwood	
Proportion (%)	80 - 90%		10 - 20%	
Species	Douglas Fir:	40 - 45%	Red Alder & Other:	10 - 20%
	W Hemlock & Other:	40 - 45%		

RAW MATERIAL DATA – GENERAL PROCESS			
Type of material	Forest residual – ground chips (325,000 GMT/y; 50%)		
Product size distribution (PSD)	< 1”	3% (by weight)	
	1 - 6”	87% (by weight)	
	> 6”	10% (by weight)	
Bulk Density	350 kg/m ³ (average)		
Water content (W.B.)	40% (average)		
Type of material	Sawdust (184,000 GMT/y; 30%)		
Product size distribution (PSD)	TBC		
Bulk Density	350 kg/m ³ (average)		
Water content (W.B.)	50% (average)		

Shavings (122,600 GMT/y; 20%)	
Type of material	
Product size distribution (PSD)	TBC
Bulk Density	150 kg/m ³ (average)
Water content (W.B.)	25% (average)

FUEL:

RAW MATERIAL SPECIES – COMBUSTION SYSTEM		
Type	Softwood	Hardwood
Proportion (%)	45 - 55%	45 - 55%
Species	Douglas Fir W Hemlock & Other	Red Alder Other

RAW MATERIAL DATA – COMBUSTION SYSTEM	
Type of material	Bark & Hogfuel (220,000 GMT/y; 100%)*
Product size distribution (PSD)	1 - 6" (approximately)
Bulk density M.C.	305 kg/m ³ (average)
Ash content	8-10%
Ash melting point	> 1100 °C
Water content (W.B.)	55 %

FINAL PRODUCT:

FINAL PELLET REQUIRED	
Material	Wood pellets
Size	3.15 < L ≤ 40 mm Diameter = 6 mm
Bulk density	650 - 750 kg/m ³
Moisture Content (m.c.) wet basis	<10%
Required capacity	400,000 metric tons/year (441,000 sh.ton/year)

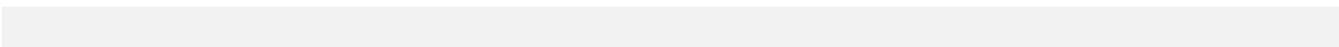
This is a **budget offer**. The final dimensioning and power of the equipment included in this offer will be defined after having analysed the raw material that the plant will work with. Meanwhile, this budget offer is based on average production figures.

Information contained in this offer is confidential and cannot be communicated to third party without our permission.

During the project realization, PRODESA reserves the right to bring all the necessary variations in design, equipment and brands in order to ensure the best operation of the plant.

GENERAL REMARKS ABOUT ELECTRICAL EQUIPMENT:

- Motors IEC and NEMA. Motors included in the offer are not NFPA/ATEX Classified
- The use of low tension for all the installation (460 V and 60 Hz) has been considered.
- MCCs, I/O and PLC panels are supplied including UL certification. The design will be according to UL 508.



3. GENERAL DESCRIPTION

For a better process understanding, please see the process mass and energy diagram 2572-PBS-04-0001A, the process flow diagram 2572-PBS-04-0002 and the layout 2572-PME-03-1001B.

3.1 RAW MATERIAL RECEPTION

We propose a truck scale system to control the raw materials received in the plant.

In order to receive the raw material and fuel, and discharge the trucks, three truck dumpers are included: one for the forest residues, other for the sawmill residues and a third one for the biomass used as fuel.

Once the product is discharged by the trucks, it will be storage in piles through a front end loader.



3.2 WET MILLING LINE

The line includes:

- Raw material moving floors
- Forest residuals cleaning and screening unit
- Sawmill residuals screening unit
- Wet hammer mills

One (1) 250 m³ MOVING FLOOR delimited by walls to store the ground chips, and a second one to store the sawdust and shavings are included.



Example of moving floor

The chips moving floor discharges the product into a chain conveyor to feed the CLEANING AND SCREENING unit, with the objective of separate impurities (sand, stones), fines and overs. Fines will be discharge to the dryer feeding system, while the intermediate fraction will be sent to the wet hammer mills. Impurities and overs will be discharged into a container (by client).



Example of cleaner and screening system

The sawdust and shavings moving floor discharges the product to a DISC SCREEN to separate big pieces that will be sent to the wet hammer mills. The good product will be sent directly to the dryer feeding system.



So, the cleaned chips will be processed in the wet hammer mills to reduce the particle size so they have an optimum drying

Two hammer mills of 500 kW each have been selected to reduce the particle size of the cleaned chips so they have an optimum drying process and they reach the dry milling stage with the optimum moisture content and size.

The produced microchips are discharged downwards by mechanical and pneumatic systems. Thus, one pneumatic system for each hammer mill is required, and each one equipped with dust collection systems, in order to control the dust emission to the atmosphere and to recover the small size particles into the product flow.



General view of wet milling line



Wet hammer mill

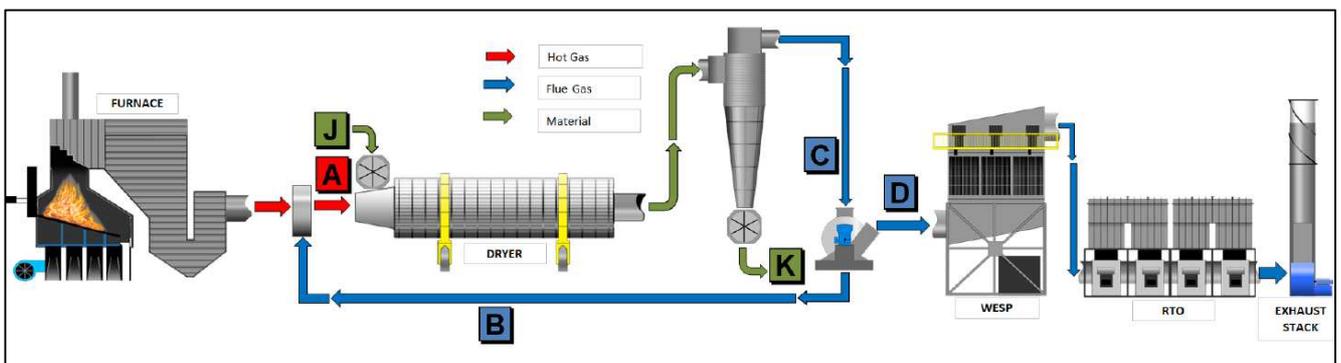
3.3 DRYER FEEDING SYSTEM

The microchips produced in the wet milling line are transported by several conveyors to the drying island.

3.4 DRYING ISLAND: DRUM DRYER AND HEAT GENERATION SYSTEM

The drying line is the heart of the plant. Design, control and operation are the key to achieve the production objectives.

The drying island includes: Heat generation system, Drum dryer, and Gases emissions treatment (WESP and RTO).



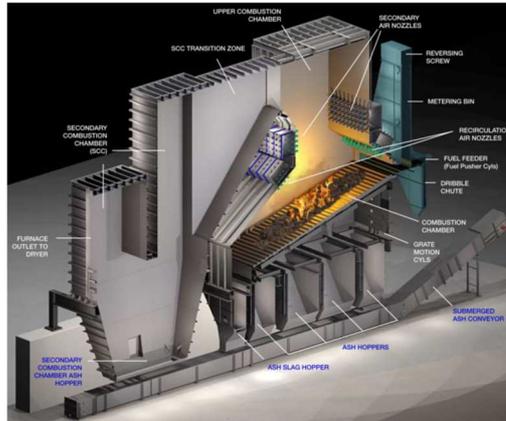
HEAT GENERATION SYSTEM: Biomass Furnace and Fuel Feeding System

We include a biomass furnace of 55 m² to provide the thermal energy required by the drum dryer. This furnace has pusher grates and a biomass dosing system by a fuel feed pushers.

A 250 m³ moving floor discharges the biomass used as fuel to a chain conveyor to feed the furnace metering bin.



Example of Heat Energy System



Heat Energy System Overview

DRUM DRYER

The selected dryer is a high temperature drum dryer that uses hot gases at around 400°C provided by a heat generation system (biomass furnace)

During the drying process the raw material features will change and it is necessary to work gently with the wood in order to keep the proper conditions to ensure the best product quality. Moisture, colour and chemical parameters of raw material are related to the drying process.

The drum dryer has the following benefits:

- Well proven drying system
- Low energy consumption
- Automated operation
- Good product quality



DRUM DRYER DESCRIPTION:

The Dryer System receives hot gas from the Heat Energy System and combines this hot gas stream with the Dryer System's flue gas stream within the Dryer System's Recycle Bustle. Once two gas streams are mixed, the resultant gas mixture enters the Dryer Drum for purpose of drying wet woody biomass.

Dryer System's Metering Bin is located at ground level and material from the Metering Bin is fed to Dryer System's Infeed Airlock via a chain conveyor.

Dryer Drum is a single-pass unit that is responsible for distributing and classifying each biomass particle to allow for its efficient drying. This is accomplished with utilization of a complex 'flighting system' within the Dryer Drum. Dried material is conveyed from the drum discharge to two (2) High Efficiency Cyclones that are responsible for effectively removing dried biomass from flue gas stream. Dried biomass exits out the bottom of High Efficiency Cyclones and into the Cyclone Airlocks; each Cyclone has its own dedicated Airlock.

Dried biomass from Cyclone Airlocks is received by a Collection Screw that conveys dried biomass to the Diverter Gate. The Diverter Gate under upset operating conditions discharges biomass to client's Fire Dump. The Diverter Gate under normal operating conditions discharges material to the dry product silo feeding chain conveyor.

Flue gas exits Cyclones out the top and is processed either to the Dryer System as recycle, or to the Pollution Control Equipment (WESP + RTO)

Biomass and flue gas is conveyed through the Dryer System via an Induced Draft Fan (ID Fan).

GASES EMISSIONS SYSTEM: WESP + RTO

To remove fine particulate from gas stream prior to discharging scrubbed flue gas stream to the atmosphere, we propose a WESP (Wet Electrostatic Precipitator).

After that, there is four-chamber RTO to receive particulate cleaned flue gas from the WESP and treat this flue gas for the purpose of VOC and CO destruction, before this flue gas is exhausted to atmosphere.



Example of WESP



Example of RTO

3.5 DRY PRODUCT STORAGE

Once the product goes out from the drying process, the moisture content is around 10% and it is transported the dry product storage by a chain conveyor.

The main aim of this is to uncouple drying line and milling line. Thus, both lines can work in an uncoupled way, increasing the production capability of the plant because during maintenance works in one line, the other one continues producing.

In addition, due to moisture content at dryer outlet is around 10%, it is required to have a certain retention time after the dryer in order to get very homogenous moisture content in the product.

During storage, the whole product is in contact and moisture content will become an average value into the silos. Homogenous moisture content means a stable pelletizing process and high pellet quality.

A chain conveyor transports the product from the outlet of the buffer silo to the milling line.

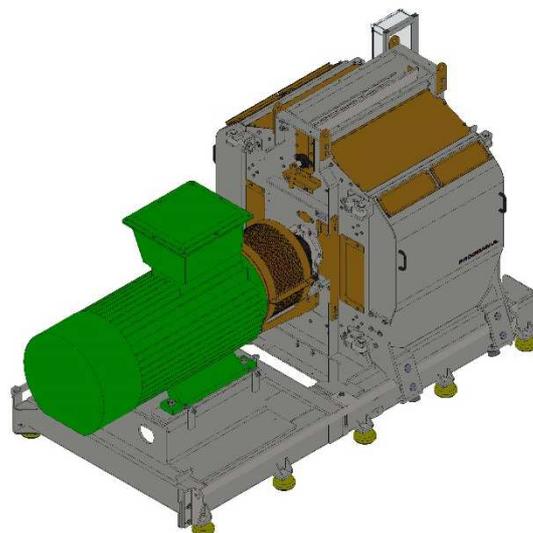


3.6 DRY MILLING LINE

As the most, dry milling line is required to reduce the particle size, thus the machines and line design has been developed to get the required wood pellet quality.

We propose one milling line with four (4) hammer mill with one (1) motor of 900 HP each one. The product is discharged by gravity system, equipped also with a cyclofilter, in order to control de dust emissions to the atmosphere.

To control de VOCs emissions, the air flow of two of the four hammer mills will pass through ~~an scrubber and RTO~~ together with the pellet cooler air flow. (Design change from RTO to RCO)



3.7 DRY AND MILLED PRODUCT STORAGE

In between the dry milling and the pelleting line there another silo for the product storage is included. The main aim of this storage is to uncouple the milling line and pelletizing line. In addition, a more homogenous moisture content in the product will be achieved which is one of the key factors to reach high pelletizing productions. At the outlet of the silo, a chain conveyor transports the product to the pelleting line.

3.8 PELLETING LINE

Pellet mills feeding will be done by a dosing screw conveyor. This system works fulltime charge in order to get the best performance in the pellet mill. A conditioner is installed between the conveyor and the pellet mill in order to adjust the moisture content in the raw material as required and to have a continuous feeding in the pellet mill.

We propose two pelleting lines with six (6) pellet mills with 500 HP each.

Once the pellet is produced, the temperature in the product is around 90°C, thus two (2) coolers (one per line) are required to achieve the quality and to comply with the pellets specifications. The cooler is equipped with a cyclone to reduce the dust emission to the atmosphere and to recover the very small size particles into the product flow. (Design change from cyclones to baghouse)

Additionally, another RTO receives VOC laden flue gas stream from the pelletizing line and from 2 dry hammer mills, which treats this flue gas for the purpose of VOC destruction, before this flue gas is exhausted to atmosphere. (Design change from RTO to RCO)

After each cooler, a vibratory screen sieves the product, thus fines and broken pellets that not comply with the specifications, are taken out from the line.

The final dimensioning and motorization of the pellet mills will be reviewed after having a raw material screen analysis and information about the wood species that will be processed.



3D – Example of pelleting line.



Pelleting line in a Pellet plant Prodesa's design

4. DESIGN DATA

4.1 RAW MATERIAL RECEPTION

Raw material	Product as in <i>Section 2. Introduction</i>
Number of truck scales	1
Number of truck dumpers	3
Truck dumper type	75' Back-On Truck Dump Platform
Empty weight of truck	30,000 lbs
Full truck weight	120,000 lbs
Platform Lift & Lower Time	4 – 4.5 min
Max. Dumping Angle	63 degrees
HPU Horsepower/unit	2 x 60 HP
Life Cycles	2,000,000 cycles

4.2 WET MILLING LINE

Raw material	Product as in <i>Section 2. Introduction</i>
RAW MATERIAL STORAGE	
Chips storage	1 x Moving floor 250 m ³ (8,828 ft ³)
Sawdust and shavings storage	1 x Moving floor 250 m ³ (8,828 ft ³)
CHIPS CLEANING AND SCREENING UNIT	
Design capacity	57.4 ton/h
Screened fractions	0 – 1.5 mm 1.5 – 10 mm 10 – 60 mm 60 – 150 mm > 150 mm
Separated impurities	Sand and stones
WET MILLING LINE	
Number of hammer mills	2
Design capacity	54.2 ton/h @ 350 kg/m ³ = 155 m ³ /h (5,474 ft ³ /h)
Hammer mill installed power (each)	500 kW (700 HP)

4.3 DRYER FEEDING SYSTEM

Raw material	Product from wet milling line
Design capacity	54.2 ton/h

4.4 DRYING ISLAND

4.4.1 HEAT ENERGY SYSTEM: Biomass Furnace

Number of Reciprocating Grate Zones	Four (4)
Wet Fuel Moisture Content (bark)	50% (wet basis)
Maximum Overall Moisture Content	55% (wet basis)
Minimum Overall Moisture Content	35% (wet basis)
Grate Fuel Design LHV at 50% mc (wet basis)	3,480 Btu/lb
Grate Fuel Design HHV at 50% mc (wet basis)	4,300 Btu/lb
Fuel Size (Maximum)	100% bark <6" 90% bark <4" 70% all fuel >2" Max 25% <1" Max 15% <1/2"
Bulk Density of Fuel (average)	18 – 20 lbs/cuft (volumetric)
Designed Combined Fuel Alkali Content	< 0.25 lb/MMBtu
Material Grate Bars	High Heat Resistant Steel (ASTM A297, Grade HD)
Grate Speed Control	10% to 100%, modulating
Thermal Turn Down Ration	4:1
Primary Air Static Pressure	5" WC
Secondary Air Static Pressure	12" WC
Number of Secondary Air Zones	Two

4.4.2 DRUM DRYER

A. Design ambient conditions:

Temperature	51° F (10 °C)
Relative humidity	85-90%

B. Product and design data:

Product inlet	Microchips from wet milling line
Product inlet moisture content	45% wet basis
Product inlet flow	85.5 ton/h @ 45% mc
Dryer technology	Drum dryer
Product outlet flow	51.11 ton/h ^[1] @ 8% mc
Dryer drum size	Ø 20' by 90' long

[1] At design ambient conditions

C. Thermal energy

Gas inlet temperature	510°C (950°F)
BTU/hr (HHV)	164,810,016

[1] At design ambient conditions and product not frozen

Remarks:

- With very wet and/or frozen raw material, water evaporation and dry raw material capacity is reduced in spite of higher energy consumption.
- If strong and short time oscillations in heat supply, product inlet moisture, particle size distribution or particle composition occur, a constant outlet moisture content cannot be guaranteed.
- If ambient conditions and/or moisture content of wet product change, the dryer capacity and also the thermal energy consumption will change.

4.4.3 GASES EMISSIONS TREATMENT: WESP + RTO

Air flow (from drum dryer)	124,031 ACFM (210,730 m³/h)
Inlet temperature	113°C (235°F)
WET ELECTROSTATIC PRECIPITATOR (WESP)	
Quantity	1
Number of Ø10” tubes	621
Number of Fields	3
REGENERATIVE THERMAL OXIDIZER (RTO)	
Quantity	1
Number of combustion chambers	4
Combustion chambers size	11’ wide by 23’ long by 8’ tall
Projected gas consumption	5.7 mmBTU/h

4.5 DRY PRODUCT STORAGE

Product	Dry product from dryer system.
Moisture content	8% (wet basis)
Description	Vertical silo.
Capacity	1,000 m³ (35,315 ft³)

4.6 DRY MILLING LINE

Inlet product	Product from dry product storage
Number of hammer mills	4
Electrical power (each one)	900 HP
Design capacity (each)	15,5 ton/h

*The final dimensioning and the motorization of the hammer mills will be reviewed after having a raw material screen analysis and information about the wood species that will be processed.

4.7 DRY AND MILLED PRODUCT STORAGE

Product	Dry and milled product from dry milling line.
Moisture content	8% (wet basis)
Description	Vertical silo.
Capacity	1,000 m ³ (35,315 ft ³)

4.8 PELLETING LINE

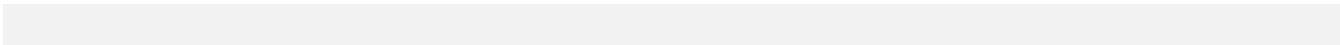
PELLETING LINE	
Product	Dry and milled product from dry milling line.
Number of pellet mills	12
Electrical power (each one)	500 HP
Design capacity (each one)	5.5 ton/h
Pellets diameter	6 mm
PELLETING LINE: RTO Client updated to RCO	
Air flow (from drum dryer)	29,500 ACFM (50,121 m ³ /h) from DHM 76,000 ACFM (129,125 m ³ /h) from pelleting line
Quantity	1
Number of combustion chambers	4
Combustion chambers size	11' wide by 23' long by 8' tall
Projected gas consumption	1.8 mMBTU/h Client updated to 2 x 2.25 MMBtu/hr

**The final dimensioning and the motorization of the pellet mill will be reviewed after having a raw material screen analysis and information about the wood species that will be processed.*

INSTALLED ELECTRICAL POWER

The table below shows the installed electrical power per lines of the equipment included in the main scope of supply of this offer. It is important to remark that these values are indicative and with no contractual value.

Description	Electrical installed power	
Raw material reception	378 HP	282 kW
Wet milling line	2,301 HP	1,717 kW
Dryer feeding system	115 HP	86 kW
Drying island	3,434 HP	2,562 kW
Dry product storage	132 HP	99 kW
Dry milling line	4,266 HP	3,183 kW
Dry and milled product storage	137 HP	103 kW
Pelleting line	7,981 HP	5,956 kW
TOTAL	18,744 HP	13,988 kW



5. EQUIPMENT DESCRIPTION

Pos	Units	Description												
5.1		RAW MATERIAL RECEPTION												
5.1.1	1	<p>Truck Scale</p> <p>Truck scale for controlling the raw material and fuel entrance. It includes a visor with high memory capacity for different products, clients, suppliers, etc.</p> <p><u>Technical data</u></p> <table> <tr> <td>Dimensions</td> <td>85.35 x 9.8 ft (26.016 x 3 m)</td> </tr> <tr> <td>Height</td> <td>11.4" (290 mm)</td> </tr> <tr> <td>Capacity</td> <td>80 ton</td> </tr> <tr> <td>Number of cells</td> <td>12 (analogics)</td> </tr> </table>	Dimensions	85.35 x 9.8 ft (26.016 x 3 m)	Height	11.4" (290 mm)	Capacity	80 ton	Number of cells	12 (analogics)				
Dimensions	85.35 x 9.8 ft (26.016 x 3 m)													
Height	11.4" (290 mm)													
Capacity	80 ton													
Number of cells	12 (analogics)													
5.1.2	3	<p>75' Back-On Truck Dumper</p> <p>It includes a 75' dumping platform</p> <p>The platform is designed for a GVW of 120,000 pounds and utilizes two 3 stage inverted telescopic cylinders which operate at a pressure of 1,600psi with a safety factor of 3:1. Once the receiving truck has backed onto the platform it is raised to its maximum angle causing the material to flow freely into the ground. The full lift and lower cycle is completed in approximately 4.5 minutes.</p> <p>It includes a walkway on the driver side as well as handrail on both the passenger and driver side</p> <p><u>Technical data/unit</u></p> <table> <tr> <td>Empty weight of truck</td> <td>30,000 lbs</td> </tr> <tr> <td>Full truck weight</td> <td>120,000 lbs</td> </tr> <tr> <td>Platform Lift & Lower Time</td> <td>4 – 4.5 minutes</td> </tr> <tr> <td>Max. Dumping Angle</td> <td>63 degrees</td> </tr> <tr> <td>HPU Horsepower</td> <td>2 x 60 HP</td> </tr> <tr> <td>Life Cycles</td> <td>2,000,000 cycles</td> </tr> </table>	Empty weight of truck	30,000 lbs	Full truck weight	120,000 lbs	Platform Lift & Lower Time	4 – 4.5 minutes	Max. Dumping Angle	63 degrees	HPU Horsepower	2 x 60 HP	Life Cycles	2,000,000 cycles
Empty weight of truck	30,000 lbs													
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Platform Lift & Lower Time	4 – 4.5 minutes													
Max. Dumping Angle	63 degrees													
HPU Horsepower	2 x 60 HP													
Life Cycles	2,000,000 cycles													

Pos	Units	Description						
5.2		WET MILLING LINE						
5.2.1	1	<p>Ground chips moving floor</p> <p>It receives the ground chips from the client´s front end loader. Delimited by concrete walls (out of PRODESA´s supply)</p> <p><u>Technical data:</u></p> <table> <tr> <td>Volume</td> <td>250 m³ (8,828 ft³)</td> </tr> <tr> <td>Number of grates</td> <td>4</td> </tr> <tr> <td>Hydraulic unit motors</td> <td>2 x 60 HP (2 x 45 kW)</td> </tr> </table>	Volume	250 m ³ (8,828 ft ³)	Number of grates	4	Hydraulic unit motors	2 x 60 HP (2 x 45 kW)
Volume	250 m ³ (8,828 ft ³)							
Number of grates	4							
Hydraulic unit motors	2 x 60 HP (2 x 45 kW)							
5.2.2	1	<p>Cleaning unit feeding chain conveyor</p> <p>It receives the ground chips from the moving floor (pos 5.2.1) and feeds the cleaning and screening unit (pos 5.2.3)</p> <p>Supports included.</p> <p><u>Technical data:</u></p> <table> <tr> <td>Total length</td> <td>126 ft (38.5 m)</td> </tr> <tr> <td>Inclination</td> <td>0º - 25º</td> </tr> <tr> <td>Installed power</td> <td>15 kW (20 HP)</td> </tr> </table>	Total length	126 ft (38.5 m)	Inclination	0º - 25º	Installed power	15 kW (20 HP)
Total length	126 ft (38.5 m)							
Inclination	0º - 25º							
Installed power	15 kW (20 HP)							
5.2.3	1	<p>Cleaning and screening unit</p> <p>To separate impurities and to screen different fractions.</p> <p>It consists on integrated roller screening and air separation units, which enables screening and cleaning of infeed material. The infeed material mix is screened into different fractions, to get a better cleaning result for each fraction.</p> <p>All rolls in the roller bed rotate in the same direction shaking and conveying the material towards the rear end of the screen. The finest fraction (e.g. sand and dust) is separated in the first roller section and accordingly the coarse fractions are separated later on the coarser section(s).</p> <p>Mixture of wood and impurities move along the roller bed, heavy contaminants are concentrated and form a mineral-enriched layer on the roller bed. Mineral-enriched layer is taken out in a larger gap. This sub-flow is further cleaned in an air cleaning unit. Sand and stones are separated by airflow and the wood material is returned to the process via cyclones.</p> <p>Defined by roller pattern and gap size (smaller than previous “removal gap” for enriched material) the fractions to be separated, go through the gaps of the rollers and fall under the roller bed for further processing.</p> <p>It includes the screens, cleaning units, pneumatic systems, structures, electrical cabinets and control system</p>						

Pos	Units	Description
5.2.4	1	<p>Cleaned and screened chips chain conveyor</p> <p>It receives the cleaned and screened chips from the cleaning and screening unit (pos 5.2.3) and discharges it into the wet hammer mills feeding chain conveyor (pos 5.2.5)</p> <p>Supports included.</p> <p><u>Technical data:</u></p> <p>Total length 224.7 ft (68.5 m) Inclination 0° - 30° Installed power 30 kW (40 HP)</p>
5.2.5	1	<p>Wet hammer mills feeding chain conveyor</p> <p>It receives the chips from the previous chain conveyor (pos 5.2.4). It includes two intermediate outlets to feed each of the wet hammer mills and a final outlet as emergency exit.</p> <p>Supports included.</p> <p><u>Technical data:</u></p> <p>Total length 82 ft (25 m) Inclination 0° Installed power 7.5 kW (10 HP)</p>
5.2.6	2	<p>Feeding system for Hammer Mill</p> <p><u>Vibratory feeder:</u></p> <p>Width: 5.9 ft (1800 mm) Length: 9.8 ft (3000 mm) Drive (per unit): 2 x 2.5 HP (2 x 1.7 kW)</p> <p>Canted and welded steel construction without cover.</p> <p>Driven by 2 maintenance-free vibration motors.</p> <p>Exit side conveyor trough of nonmagnetic VA steel if magnetic drum is used.</p> <p><u>Magnetic drum:</u></p> <p>Diameter: 1.3 ft (406 mm) Length: 6.4 ft (1965 mm) Drive (per unit) 1.5 HP (1.1 kW)</p> <p>Complete with clamp bearing, gear motor and dust hood.</p> <p><u>Support frame:</u></p> <p>For feeding system.</p>

Pos	Units	Description								
5.2.7	2	<p>Wet Hammer mill Type HH 600x2000</p> <p>Consisting of:</p> <p>Heavy particle separator type CLEANER, installed at the material infeed chute of the Hammer Mill.</p> <p>CLEANER housing with adjustable guide plates, and expansion room, 2 fans each 4 kW with compensator and blowing in channel.</p> <p><u>Hammer Mill type HH 600 x 2000.</u></p> <p>Direction of rotor rotation: right-handed or left-handed, reversible.</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 60%;">Infeed opening</td> <td style="text-align: right;">2 x 6.6 ft (600 x 2000 mm)</td> </tr> <tr> <td>Rotor diameter</td> <td style="text-align: right;">6.6 ft (2000 mm)</td> </tr> <tr> <td>Motor power</td> <td style="text-align: right;">670 HP (500 kW)</td> </tr> <tr> <td>Self-propelled air</td> <td style="text-align: right;">16 000 m³/h</td> </tr> </table> <p><u>Basic equipment:</u></p> <p>Vertical infeed.</p> <p>Infeed flap, adjustable to direct the material for right-handed or left-handed rotation, hydraulically.</p> <p>Three-part machine housing in welded steel construction.</p> <p>Machine sides folding away hydraulically.</p> <p>Screens and milling tracks integrated in side parts</p> <p>Milling tracks surface hardened</p> <p>Rotor in arc welded steel construction, dynamically balanced, with swinging hammers made out of special steel, pendulous suspended on hardened shafts.</p> <p>Hammers with 2 drill holes therefore all 4 edges can be used.</p> <p>V-belt pulley mounted at the rotor shaft.</p> <p>Zero-speed control (24 V DC) for rotor speed.</p> <p>Limit switch at the housing side parts.</p> <p>All electrical components wired on a conduit box.</p>	Infeed opening	2 x 6.6 ft (600 x 2000 mm)	Rotor diameter	6.6 ft (2000 mm)	Motor power	670 HP (500 kW)	Self-propelled air	16 000 m ³ /h
Infeed opening	2 x 6.6 ft (600 x 2000 mm)									
Rotor diameter	6.6 ft (2000 mm)									
Motor power	670 HP (500 kW)									
Self-propelled air	16 000 m ³ /h									
5.2.8	2	<p>Dust extraction system for Hammer mill</p> <p>It includes:</p> <ul style="list-style-type: none"> - Piping and connection to machine. - Cyclone separator complete with rotary valve and steel support: <table style="width: 100%; border: none; margin-left: 20px;"> <tr> <td style="width: 60%;">Air flow</td> <td style="text-align: right;">Up to 16 000 m³/h</td> </tr> <tr> <td>Installed power rotary valve</td> <td style="text-align: right;">0.5 HP (0.37 kW)</td> </tr> </table> - Radial fan <table style="width: 100%; border: none; margin-left: 20px;"> <tr> <td style="width: 60%;">Air flow</td> <td style="text-align: right;">Up to 16 000 m³/h</td> </tr> <tr> <td>Installed power</td> <td style="text-align: right;">50 HP (37 kW)</td> </tr> </table> 	Air flow	Up to 16 000 m ³ /h	Installed power rotary valve	0.5 HP (0.37 kW)	Air flow	Up to 16 000 m ³ /h	Installed power	50 HP (37 kW)
Air flow	Up to 16 000 m ³ /h									
Installed power rotary valve	0.5 HP (0.37 kW)									
Air flow	Up to 16 000 m ³ /h									
Installed power	50 HP (37 kW)									

Pos	Units	Description						
5.2.9	2	<p>Screw conveyor</p> <p>U-shaped conveyor trough of 5 mm bent steel plate, with bolted-on cover.</p> <p>Auger (screw) of 8 mm steel plate, welded on center shaft. Center shaft with bolted, exchangeable shaft ends running in double-row spherical roller bearings.</p> <p>Anti-clockwise rotating auger. Drive unit with hollow-shaft mounted flat gear of type Nord (standard) or SEW.</p>						
5.2.10	1	<p>Microchips chain conveyor</p> <p>It collects the microchips produced in the two wet hammer mills and discharges it to the dryer feeding conveyors.</p> <p>Supports included</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Total length</td> <td style="text-align: right;">69 ft (21 m)</td> </tr> <tr> <td>Inclination</td> <td style="text-align: right;">0° - 45°</td> </tr> <tr> <td>Installed power</td> <td style="text-align: right;">11 kW (15 HP)</td> </tr> </table>	Total length	69 ft (21 m)	Inclination	0° - 45°	Installed power	11 kW (15 HP)
Total length	69 ft (21 m)							
Inclination	0° - 45°							
Installed power	11 kW (15 HP)							
5.2.11	1	<p>Sawdust and shavings moving floor</p> <p>It receives the sawdust and shavings from the client’s front end loader. Delimited by concrete walls (out of PRODESA’s supply)</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Volume</td> <td style="text-align: right;">250 m³ (8,828 ft³)</td> </tr> <tr> <td>Number of grates</td> <td style="text-align: right;">4</td> </tr> <tr> <td>Hydraulic unit motors</td> <td style="text-align: right;">2 x 60 HP (2 x 45 kW)</td> </tr> </table>	Volume	250 m ³ (8,828 ft ³)	Number of grates	4	Hydraulic unit motors	2 x 60 HP (2 x 45 kW)
Volume	250 m ³ (8,828 ft ³)							
Number of grates	4							
Hydraulic unit motors	2 x 60 HP (2 x 45 kW)							
5.2.12	1	<p>Disc screen feeding chain conveyor</p> <p>It receives the product from the moving floor (pos 5.2.11) and feeds disc screen (pos 5.2.12)</p> <p>Supports included.</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Total length</td> <td style="text-align: right;">98.4 ft (30 m)</td> </tr> <tr> <td>Inclination</td> <td style="text-align: right;">0° - 15°</td> </tr> <tr> <td>Installed power</td> <td style="text-align: right;">11 kW (15 HP)</td> </tr> </table>	Total length	98.4 ft (30 m)	Inclination	0° - 15°	Installed power	11 kW (15 HP)
Total length	98.4 ft (30 m)							
Inclination	0° - 15°							
Installed power	11 kW (15 HP)							
5.2.13	1	<p>Disc screen</p> <p>It receives the product from the previous conveyor (pos 5.2.12). To separate big pieces. The good product is discharged to a conveyor that feeds the dryer feeding system.</p> <p>Driven by gearbox and chain transmission.</p> <p>It includes the upper and lower hopper for connection with the previous and post chain conveyors.</p>						

Pos	Units	Description						
5.2.14	1	<p>Disc screen outlet chain conveyor</p> <p>It receives the product from the disc screen (pos 5.2.13) and discharges the dryer feeding system.</p> <p>Supports included.</p> <p><u>Technical data:</u></p> <table> <tr> <td>Total length</td> <td>44.2 ft (13.5 m)</td> </tr> <tr> <td>Inclination</td> <td>0°</td> </tr> <tr> <td>Installed power</td> <td>5.5 kW (7.5 HP)</td> </tr> </table>	Total length	44.2 ft (13.5 m)	Inclination	0°	Installed power	5.5 kW (7.5 HP)
Total length	44.2 ft (13.5 m)							
Inclination	0°							
Installed power	5.5 kW (7.5 HP)							
5.2.15	1	<p>Structures and painting</p> <p>Metal structures necessary for the support of described equipment, as well as access stairs and walkways required for the inspection and maintenance of the facility.</p> <p>All items (except stainless and galvanized steel) are supplied with a first coat of synthetic painting according to our standard RAL.</p>						

Pos.	Units	Description						
5.3		DRYER FEEDING SYSTEM						
5.3.1		<p>Wet product chain conveyor</p> <p>It receives the microchips from the wet hammer mills (pos.5.2.10) and the sawdust and shavings from the disc screen outlet conveyor (pos 5.2.14), and discharges it to the dryer feeding chain conveyor.</p> <p>Supports included.</p> <p><u>Technical data:</u></p> <table> <tr> <td>Total length</td> <td>220 ft (67 m)</td> </tr> <tr> <td>Inclination</td> <td>0° - 45°</td> </tr> <tr> <td>Installed power</td> <td>37 kW (50 HP)</td> </tr> </table>	Total length	220 ft (67 m)	Inclination	0° - 45°	Installed power	37 kW (50 HP)
Total length	220 ft (67 m)							
Inclination	0° - 45°							
Installed power	37 kW (50 HP)							
5.3.2	1	<p>Dryer feeding chain conveyor</p> <p>It receives the product from the previous chain conveyor (pos 5.3.1) and feeds the dryer dosing bin</p> <p>Supports included</p> <p><u>Technical data:</u></p> <table> <tr> <td>Total length</td> <td>207 ft (63 m)</td> </tr> <tr> <td>Inclination</td> <td>20°</td> </tr> <tr> <td>Installed power</td> <td>45 kW (60 HP)</td> </tr> </table>	Total length	207 ft (63 m)	Inclination	20°	Installed power	45 kW (60 HP)
Total length	207 ft (63 m)							
Inclination	20°							
Installed power	45 kW (60 HP)							
5.3.3		<p>Structures and painting</p> <p>Metal structures necessary for the support of described equipment, as well as access stairs and walkways required for the inspection and maintenance of the facility.</p> <p>All items (except stainless and galvanized steel) are supplied with a first coat of synthetic painting according to our standard RAL.</p>						

Pos	Units	Description						
5.4	1	Drying Island: DRUM DRYER						
5.4.1	1	<p>Hot Gas Isolation Gate</p> <p>The Hot Gas Isolation Gate is bolted between the Heat Energy System and Recycle Bustle. This gate enables plant personnel to seal off the Dryer System from the hot gasses generated by the Heat Energy System.</p> <p>When activated, to hold back gasses generated by the Heat Energy System from entering the Dryer System, and thus provide safe passage for plant maintenance personnel into the Dryer System.</p> <p><u>Technical data:</u></p> <table> <tr> <td>Housing material</td> <td>3/8” thick A36 mild steel</td> </tr> <tr> <td>Gate material</td> <td>12 mm thick 304 SS</td> </tr> <tr> <td>Actuator</td> <td>Twin hydraulic cyclinders</td> </tr> </table>	Housing material	3/8” thick A36 mild steel	Gate material	12 mm thick 304 SS	Actuator	Twin hydraulic cyclinders
Housing material	3/8” thick A36 mild steel							
Gate material	12 mm thick 304 SS							
Actuator	Twin hydraulic cyclinders							
5.4.2	1	<p>Recycle system</p> <p>To control the flow of Dryer System flue gas back to the Dryer System via the Recycle Bustle.</p> <p>The Recycle System consists of gas ductwork that runs from the discharge of the Dryer System’s ID Fan to the Recycle Bustle; the Recycle Bustle is located between the Burner and the Dryer Drum. Within this ductwork is a Recycle Damper that controls the amount of flue gas recycled.</p>						
5.4.3	1	<p>Recycle bustle</p> <p>To accept recycled gas from the Dryer Exhaust System and blend it back into the incoming hot gas stream generated by the Heat Energy System.</p>						
5.4.4	1	<p>Inlet fitting</p> <p>To act as a conduit for the transition of the homogeneous drying gas from the Recycle Bustle into the Dryer Drum and for the introduction of the wet woody biomass to be dried into the Dryer Drum</p>						
5.4.5	1	<p>Purge Fan</p> <p>To purge the Dryer System clean of combustible gas to prevent explosions from occurring within the Dryer System</p>						
5.4.6	1	<p>Metering Bin</p> <p>To receive the wet material from the chain conveyor pos 5.3.2, store it and meter it to the infeed airlock.</p> <p>The Metering Bin is located above the Infeed Airlock. The Metering Bin contains augers at bin bottom that are driven by a Variable Frequency Drives.</p>						

Pos	Units	Description
		<p>The augers feed/meter the product to the infeed airlock. Above the auger there is an agitator that distributes the product evenly across the augers to ensure proper and constant feed of the augers.</p> <p><u>Technical data:</u> Capacity: Approx 30 minutes</p>
5.4.7	1	<p>Infeed Airlock</p> <p>To receive wet material from the Metering Bin and discharge it onto the louvered chute of the Inlet Fitting.</p> <p>The Infeed Airlock comprises a formed machined steel body with a rotating vane. The vane has eight pockets with knife tips. The design loading is based on achieving the optimum balance between minimizing the introduction of ambient air into the system and creating a maximum, nonplugging load in each pocket.</p>
5.4.8	1	<p>Rotary drum</p> <p>The Drum assembly consists of three major subassemblies: the Drum, the trunnion assemblies, and the drive.</p> <p>The Drum is a cylindrical structure formed of rolled mild steel plate, reinforced with structural section channel, tee, and angle ribs, and external bands. The Drum rides on two full diameter forged tracks. The Drum's interior is a network of lifting flights and baffles, designed to shower material across the Drum's cross-section as it rotates and to regulate the forward movement of material through the Drum. Around the circumference of the Drum are mounted segmented chain teeth sets, on which a roller chain rides. Drum rotation is effected by an electric motor and a gear reducer.</p> <p>The Drum's tires are supported on four trunnion wheels, arranged in opposed pairs at the two track locations. Each trunnion is cast and machined from nodular iron, with shafts riding in split pillow-block spherical roller bearings. Rear trunnion wheels are flanged to fix the location of the Drum.</p> <p>Seals are located at both ends of the drum and are designed to limit ambient air infiltration. Seals are mounted to adapter-taper fittings to insure alignment. Drive chain, trunnions wheels, and tracks are lubricated by Molybdenum Blocks. The Drum is clad with a corrugated skin held in place with stainless steel bands. This creates an air gap which acts as insulation.</p> <p><u>Technical data:</u> Length: 90' Diameter: 20'</p>

Pos	Units	Description
5.4.9	1	<p>Ductwork</p> <p>To convey dried biomass and spent gas from the Drum discharge to the High Efficiency Cyclone, and to convey spent gas from the High Efficiency Cyclone discharge to the ID Fan, and from the ID Fan either to the Recycle Bustle and Emission Control Equipment.</p> <p>The Ductwork is made from rolled mild steel. There are essentially two types of Duct in the system: Material Duct that conveys both spent gas and entrained particulate and Gas Duct that conveys spent gas only.</p>
5.4.10	1	<p>Double-Duct</p> <p>To keep inner walls of the ductwork after material separating Cyclones hotter than the condensable temperature of the complex hydrocarbons that evaporate from woody biomass during the drying process thus prevent 'pitch' buildup</p> <p>Double-Duct encompasses the duct from Cyclone discharge to the ID Fan inlet; it also encompasses the recycle duct, which runs from ID Fan to the Recycle Bustle, and duct from ID Fan to WESP's Quench Duct.</p> <p>Double-Duct is heated via natural gas burners.</p> <p>Sole purpose of the Double-Duct is to keep the inner walls of the process duct (process duct processes Dryer System flue gas) hotter than the condensable temperature of complex hydrocarbons that evaporate from woody biomass during the drying process. This prevents hydrocarbons from condensing onto inner walls of the process duct, which is commonly in the industry referred as 'pitch' buildup. Pitch buildup is prone to fires, explosions, and while it accumulates it slowly reduces production capacity of the Dryer Island due to restricting air flow. It is very costly and time consuming to manually clean 'pitch' buildup.</p>
5.4.11	2	<p>High efficiency cyclones</p> <p>To separate dried biomass from the spent gas and deliver it into the Cyclone Airlock.</p> <p>High Efficiency Cyclone accepts spent gas and dried material from the incoming Material Duct. The inlet geometry features a tangential transition to the tub section with inlet angle between Material Duct and transition of fifteen degrees. The cone section is a relatively shallow angle for better efficiency at removing smaller particulate from the gas stream. At the exit to the cone there is an oversized Vortex Breaker with anti-spin baffles to effectively stop the cyclonic action of the material and to evenly distribute it into the Cyclone Airlock pockets minimizing the risk of plugging and wear on the tips of the Airlock. Spent gas is drawn from the top of the Cyclones into the Gas Duct. Explosion relief panels are located on top of the Cyclone.</p>

Pos	Units	Description
5.4.12	2	<p>Cyclone Airlock</p> <p>To receive dried biomass from the High Efficiency Cyclone and discharge dried biomass to Collection Screw(s). High Efficiency</p> <p>The Cyclone Airlock comprises a formed machined steel body with a rotating vane. The vane has eight pockets with knife tips. The design loading is based on achieving the optimum balance between minimizing the introduction of ambient air into the system and creating a maximum, nonplugging load in each pocket</p>
5.4.13	1	<p>Collection screw</p> <p>To collect dried material from the Cyclone Airlocks, and process dried material to the dry product chain conveyor or to client’s Fire Dump.</p>
5.4.14	1	<p>ID Fan</p> <p>To provide the motive force and requisite pressures through the Dryer System.</p> <p>The ID Fan is positioned at grade level after the High Efficiency Cyclone and connects to Gas Ductwork on both the inlet and the outlet sides. It draws gas through the entire Dryer System prior to the inlet and then forces some gas back into the Dryer System via the Recycle Bustle and the remainder of the gas to the WESP.</p> <p>There are expansion joints located at both the inlet and the outlet of the ID Fan that accommodate for the thermal expansion of the Gas Ductwork, but also isolate the Ductwork from any potential vibrations originating with the ID Fan.</p> <p>The ID Fan flow is modulated via a Variable Frequency Drive and it is governed by the pressure differential reading across the High Efficiency Cyclones</p> <p><u>Technical data:</u></p> <p>Type: Single wheel, double inlet, centrifugal, class IV. Blade Shape: Radial. Speed: 1,200 rpm Access: Man door for maintenance</p>
5.4.15	1	<p>Recycle & Stack Dumper</p> <p>To control the flow of gas to the Recycle Bustle or to the Pollution Control Equipment.</p>

Pos	Units	Description
5.4.16	1	<p>Emergency Abort Stack</p> <p>To vent Dryer System gasses to atmosphere during upset operating conditions</p> <p>At times the Dryer System flue gas will need to be aborted to atmosphere during upset operating conditions; rather than sending these flue gasses to the Pollution Control Equipment or to the Heat Energy System.</p> <p>The Emergency Abort Stack provides the ability to vent gases to atmosphere during upset operating conditions. The control damper is air actuated and is fail safe; if there is a power outage or air failure the Emergency Abort Stack will automatically open.</p> <p><u>Technical data:</u></p> <p>Height Approx. 65' above grade Diameter 50"</p>
5.4.17	1	<p>Dryer System Control Devices</p> <p>The following devices are included in order to control the Dryer System via PLC:</p> <ul style="list-style-type: none"> • Temperature Control Sensors • Temperature Transmitters • Pressure Transmitters • Speed Switches • Proximity Switches (Capacitive and Inductive) • Plug Detectors • Deluge Nozzles
5.4.18	1	<p>Spark detection and suppression</p> <p>To monitor the Dryer System for sparks and fires, and extinguish those sparks and fires.</p> <p>The Spark Detection and Suppression monitors various locations within the Dryer. System. Deluge nozzles are linked to the spark detection devices and respond appropriately based on input. The deluge works in conjunction with the Diverter Gate to abort material to the Buyer's Fire Dump.</p> <p>The Spark Detection and Suppression is integrated into the overall Dryer System controls with audible fire alarm, control panel display, and fire sequence relay.</p>
5.4.19	1	<p>Structures, supports and platforms</p> <p>All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passage ways needed for the correct inspection and maintenance of the installation.</p> <p>All the equipment (except those in inox steel) are supplied with a layer of epoxy covered by a layer of synthetic paint, according with our standard RAL.</p>

Pos	Units	Description
5.5	1	Drying Island: HEAT ENERGY SYSTEM
5.5.1	1	<p>Fuel moving floor</p> <p>It receives the biomass used as fuel from the client’s front end loader. Delimited by concrete walls (out of PRODESA’s supply)</p> <p><u>Technical data:</u></p> <p>Volume 250 m³ 8,828 ft³) Number of grates 4 Hydraulic unit motors 2 x 60 HP (2 x 45 kW)</p>
5.5.2	1	<p>Fuel feeding chain conveyor</p> <p>It receives the biomass from the fuel moving floor (pos 5.5.1) and discharges it into the furnace flop gate (pos 5.5.3)</p> <p><u>Technical data:</u></p> <p>Total length 171 ft (52 m) Inclination 20° Installed power 11 kW (15 HP)</p>
5.5.3	1	<p>Flop Gate</p> <p>The Flop Gate provides isolation of the fuel feed system from the Fuel Feed Conveyor.</p> <p>The Flop Gate only opens when the Furnace is calling for fuel based on low level sensor located in the Metering Bin. The Flop Gate blocks air (oxygen) from getting inside the Metering Bin during fuel feed upsets or when shutting down a Furnace which contributes to fires</p>
5.5.4	1	<p>Reversing screw</p> <p>The Reversing Screw is located directly above the Metering Bin and directs fuel to both sides of the Metering Bin, thus ensuring even fuel distribution within the Metering Bin.</p> <p>It provides for even fuel feed into the Furnace from the Metering Bin. The motor driving the screw is a reversing motor.</p>
5.5.5	1	<p>Metering bin</p> <p>The Metering Bin consists of fuel feed pushers that push fuel onto the Combustion Chamber’s grates, and cover the entire grate area with fuel at a controlled fuel bed level.</p> <p>The complete grate area forms an active drying and combustion area. A double alarm system (level control furnace and level control fuel feeders) warns operator in case of interruptions of fuel supply. A gate valve and sprinkler system are installed for prevention of back burning into the Metering Bin.</p> <p>The Metering Bin provides approximately fifteen (15) minutes of fuel storage capacity.</p>

Pos	Units	Description
5.5.6	1	<p>Reciprocating Grate Combustion Chamber</p> <p>The Combustion Chamber constructed of a robust steel frame structure with moving and stationary grate frames. Reciprocating grate bars are carried by moving support frames. Stationary grate bars are supported by the structure frame. The Reciprocating Grate frames and grate bars are supported on ball bearings. There are four (4) zones of moving grates within the Furnace.</p> <p>The grate bars are of high heat resistant alloy with cooling fins to prevent overheating; water cooling is not required. The grate bars are overlapping, thus preventing through fall of unburned fuel. A hydraulic power pack with pump operates the fuel feeders and grates.</p> <p>The primary combustion air enters the fuel bed from the under-fire air zone through slots between the grate bars. The sides of the grate's assembly are cast steel side bars to protect the refractory of the furnace from abrasion by the moving grate bars.</p> <p>The reciprocating grate bars are activated by hydraulic cylinders. The relative movement between stationary and moving grate bars causes the fuel to continually turn and convey along the grate to enhance the combustion process.</p>
5.5.7	1	<p>Hydraulic Power Pack</p> <p>Hydraulics for ram feeder, shut off slide, grate cylinders, and the last grate section.</p> <p>Hydraulic Power Pack unit complete with one high-capacity hydraulic pump, complete with coupling, guard, three 4-way directional solenoid valves, tank trim, all components pre-piped, and mounted on a rigid tank.</p>
5.5.8	1	<p>Hydraulic Displacement Pumps</p> <p>Hydraulic Displacement Pumps operate all four (4) grate sections of the Furnace and control the speed of the strokes based on firing rate and controlling the speed of the pumps. Each pump motor requires a variable frequency drive.</p>
5.5.9	1	<p>Primary Air Fan</p> <p>Forced draft fan with flanged inlet and outlet, inlet vane control damper, electric actuator with linkage and mounting bracket.</p> <p>The Primary Air Fan provides the primary combustion air into the under-fire air zones. Air is fed from under the grate bars and is controllable in each of the four sections</p>
5.5.10	1	<p>Secondary Air Fan</p> <p>Secondary Air Fan is a forced draft fan with flanged inlet and outlet, inlet vane control damper, electric actuator with linkage and mounting bracket.</p> <p>The Secondary Air Fan feeds the air over the fuel pile for complete combustion of fuel.</p>

Pos	Units	Description
5.5.11	1	<p>Furnace Casing and Combustion Air Ducts</p> <p>Carbon steel construction for the complete chamber with external stiffening beams. Ducting for the Primary and Secondary Air Fans from the fans to the Furnace air boxes and headers.</p>
5.5.12	1	<p>Secondary Combustion and Dropout Chamber</p> <p>This chamber provides final combustion of the gases from the Furnace.</p> <p>The chamber also provides for mixing of the furnace gas with the Dryer System flue gas. After mixing and blending, the gases are discharged to the Dryer ducting.</p> <p>The Chamber is refractory lined and includes a dropout chamber and flue gas turn around design for maximum removal of fly ash in front of the Dryer.</p> <p>The chamber is designed with the top as a secondary combustion chamber to burn-out the carry over and the bottom as an ash drop-out in order to get clean burned out gas that can be directly fed into the dryer.</p>
5.5.13	1	<p>Refractory</p> <p>Internal refractory block insulation rated to 1900°F. Furnace material is plastic rated to 2700°F. Using low cement materials and installation to be done using shot-crete method. To be blown-in-place on site.</p>
5.5.14	1	<p>Submerged Ash Conveyor</p> <p>Submerged Ash Conveyor of drag chain design, complete with gearbox and drive, collects ash from underneath the Furnace grate. Submerged Ash Conveyor provides an air lock for the Furnace ash hoppers</p>
5.5.15	1	<p>Emergency Exhaust Stack</p> <p>Mounted on top of the Furnace and includes automatic hydraulic damper.</p> <p>The purpose of the Emergency Stack is to open at high temperature and/or high pressure in the system and at power failures.</p> <p>It is fabricated from mild steel and refractory-lined for the first 5 feet above the furnace roof. The remainder of the stack is made of stainless steel and includes one pneumatically operated damper on top as a stack cap. Stack cap is made of stainless steel and also has refractory lining.</p> <p><u>Technical data:</u></p> <p>Height Approx. 50 ft above grade</p>
5.5.16	1	<p>Video Camera and Monitor</p> <p>One (1) air-cooled video cameras are provided at the rear end of the Furnace with one (1) monitors to allow for visual inspection of the furnace combustion process from the operator room.</p> <p>The video monitors will be located in the operator control room</p>

Pos	Units	Description
5.5.17	1	<p>Heat Energy System Control Devices</p> <p>The following devices are included in order to control the Heat Energy System via PLC:</p> <ul style="list-style-type: none"> • Temperature Control Sensors • Temperature Transmitters • Zero Speed Switches • Pressure Transmitters • Proximity Switches (Capacitive and Inductive) • Level Indicators • Deluge Nozzles
5.5.18	1	<p>Structures, supports and platforms</p> <p>All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passage ways needed for the correct inspection and maintenance of the installation.</p> <p>All the equipment (except those in inox steel) are supplied with a layer of epoxy covered by a layer of synthetic paint, according with our standard RAL</p>

Pos	Units	Description								
5.6	1	Drying Island: WET ELECTROSTATIC PRECIPITATOR (WESP)								
5.6.1	1	<p>Inlet Quench Duct</p> <p>The Inlet Quench Duct is equipped with recycled water sprays to saturate the gas stream and also scrub out the large particulate present in the exhaust gas. The Inlet Quench Duct attaches to the corresponding</p>								
5.6.2	1	<p>Wet Electrostatic Precipitator (WESP)</p> <p>One Complete WESP unit will be provided. The unit will be complete with collecting electrodes, discharge electrodes, and a suspended power grid</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Design Pressure</td> <td style="text-align: right;">± 25 IWC (0.06 bar)</td> </tr> <tr> <td>Collection Electrodes</td> <td style="text-align: right;">304L SS</td> </tr> <tr> <td>Discharge Electrodes</td> <td style="text-align: right;">304L SS</td> </tr> <tr> <td>Collection Section Housing</td> <td style="text-align: right;">304L SS tubes and tube sheets A36 CS steel structural supports A36 CS partical external skin</td> </tr> </table>	Design Pressure	± 25 IWC (0.06 bar)	Collection Electrodes	304L SS	Discharge Electrodes	304L SS	Collection Section Housing	304L SS tubes and tube sheets A36 CS steel structural supports A36 CS partical external skin
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Collection Electrodes	304L SS									
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Collection Section Housing	304L SS tubes and tube sheets A36 CS steel structural supports A36 CS partical external skin									
5.6.3	1	<p>Quench Water Recycle</p> <p>The Quench Water Recycle will include a common recycle tank with one (1) recycle pump.</p> <p>Recycle water is sprayed into the quench duct and spent recycle water will gravity drain into the recycle tank located beneath the WESP.</p> <p>The Quench Water Recycle will be controlled automatically by the PLC control system. Make up water requirements due to evaporation or blow down will be satisfied with flush water or on demand by level control</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Recycle Tank capacity</td> <td style="text-align: right;">20,000 gallons (75 m3)</td> </tr> <tr> <td>Recycle Pumps capacity</td> <td style="text-align: right;">2,500 gallon/min (9,375 l/min)</td> </tr> </table>	Recycle Tank capacity	20,000 gallons (75 m3)	Recycle Pumps capacity	2,500 gallon/min (9,375 l/min)				
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5.6.4	1	<p>Decanter Centrifuge</p> <p>The Decanter Centrifuge removes solids collected by the Wet ESP and is required for the system.</p> <p>The Decanter Centrifuge is configured to treat a slipstream of up to 50 gallons per minute (187.5 liters/minute) of recycle water from the Wet ESP.</p> <p>The cake produced by the Decanter Centrifuge will be approximately 50% solids by weight and, depending on the nature of the solids, can be burned in the Reciprocating Step-Grate Furnace or sent to landfill.</p> <p>The centrate (cleaned water) will gravity drain back to the recycle tank. A small blow-down stream of approximately 2 gallons per minute (7.5 liters/minute) will</p>								

Pos	Units	Description
		also be necessary to control dissolved solids. The exact amount will be determined after start up based on dissolved solids level..
5.6.5	1	<p>Chemical Injection</p> <p>The Chemical Injection is incorporated into the flush and recycle systems. This system is designed to periodically inject sodium hydroxide (NaOH) directly into the flush water to aid in cleaning of the Wet ESP collection tubes. The flush and caustic systems will be controlled by the Dryer Island PLC.</p> <p>The Chemical Injection is also designed to inject a de-foaming agent into the water recirculation system to control foam when it occurs. The de-foaming system will be controlled at the PLC and also have the capability for manual control. The caustic and de-foaming system will be enclosed in a containment area. It is recommended that the entire system be insulated and heat traced.</p>
5.6.6	1	<p>High Voltage Power Supply</p> <p>Type: 3 phase, air cooled.</p> <p>T/R: NEMA 4.</p> <p>Control Panel: NEMA 1 to be located in MCC</p> <p>Output Rating: 70 kilovolt, 1500 milliamp.</p> <p>Input Power: 105 KVA, 460 V / 3-phase / 60 Hz.</p> <p>High Voltage Transmission: Pipe in grounded duct.</p> <p>Features: Control Panel with digital controller, KV and MA signal transmitters; remote start/stop function; grounding switch; key interlock system.</p>
5.6.7	1	<p>Purge Air</p> <p>Purge Air will provide clean, warm air to all support insulators to prevent fouling by process gas.</p> <p>The Purge Air System will also be equipped with a ducting network that uses the tube bundle for pre-heating the air</p>
5.6.8	1	<p>Flush System</p> <p>Type: Intermittent sprays.</p> <p>Flushed Areas: Collection sections (tubes and probes) plus mist eliminator.</p> <p>Features: All required nozzles and internal headers are provided. One feed system consisting of heated flush tank immersed in the recycle water for heat transfer purposes and a pump will be supplied. Hot water with caustic added is much more effective in removing sticky organic deposits from the collection tubes than cold water</p>

Pos	Units	Description
5.6.9	1	<p>Control Devices</p> <p>The following devices are included in order to control the WESP via PLC:</p> <ul style="list-style-type: none"> • Temperature Control Sensors • Temperature Transmitters • Zero Speed Switches • Pressure Transmitters • Proximity Switches (Capacitive and Inductive) • Level Indicators • PH Level Indicators
5.6.10		<p>Structures, supports and platforms</p> <p>All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passage ways needed for the correct inspection and maintenance of the installation.</p> <p>All the equipment (except those in inox steel) are supplied with a layer of epoxy covered by a layer of synthetic paint, according with our standard RAL</p>

Pos	Units	Description
5.7	1	Drying Island: REGENERATIVE THERMAL OXIDIZER (RTO)
5.7.1	1	Inlet manifold Materials of Construction: Type 304L stainless steel, with minimum 10-gauge thickness, adequately stiffened to withstand maximum internal pressures. Operational Parameters: ±25 IWC; 176°F (0.06 bar @ 80°C). Access: One access door for internal inspection of inlet manifold
5.7.2	1	Diverter Valves Materials of Construction: Type 304L stainless steel 3/16 in. thick and adequately stiffened to withstand maximum internal pressures. Operational Parameters: ±25 IWC; 176°F (0.06 bar @ 80°C) inlet and 209°F outlet (98°C); maximum operational temperature is 600°F (316°C) during bake-out, and occurrence is for duration of 15-minute intervals. Valve Trim Construction: Main disk 3/16-inch-thick, Type 2101 duplex stainless steel; support disks 3/16-inch-thick Type 304L stainless steel. Seat materials are Type 304L stainless steel. Seal arrangement is metal to metal sealing surfaces without elastomeric compounds that would damage during bake-out. Access: One access door for internal inspection. Valve Actuation System: Parker 2A heavy duty pneumatic cylinder, adjustable end cushions at each end of travel; direct link with Parker linear alignment coupling, inductive proximity switches measuring actual valve shaft position, actuation time is 0.5 seconds full open to full close; the assembly is pre-assembled and pre-wired to junction box.
5.7.3	1	Hopper Transitions Materials of Construction: Type 304 stainless steel 3/16-inch-thick and adequately stiffened to withstand maximum internal pressures. Operational Parameters: ±25 IWC; 176°F (0.06 bar @ 80°C) inlet and 209°C outlet (98°C); maximum operational temperature is 600°F (316°C) during bake-out.
5.7.4	1	Heat Recovery Sections Materials of Construction: Type 304L stainless steel 3/16-inch-thick and adequately stiffened to withstand maximum internal pressures Operational Parameters: ±25" IWC (0.06 bar); 176°F (80°C) inlet and 1500°F outlet (816°C); maximum operational temperature 1800°F (982°C) at top and 1100°F (593°C) at bottom. Media Support Structure: Type 304 stainless steel structure with laser cut slotted plate; maximum design temperature of 1100°F (593°C); maximum free passage of 70% open area; centered in heat recovery chamber with no direct contact to outside walls; both ends floating to allow for thermal expansion.

Pos	Units	Description
		Access: Inspection access to the support structures is through the diverter valve; inspection access to top of heat recovery section is through combustion chamber access.
5.7.5	1	<p>Combustion Chamber</p> <p>Materials of Construction: Type 304L stainless steel 3/16-inch-thick and adequately stiffened to withstand maximum internal pressures.</p> <p>Operational Parameters: ±25 IWC (0.06 bar); normal operation 1500°F (816°C); maximum operational temperature 1800°F (982°C).</p> <p>Access: One access door in the combustion chamber</p>
5.7.6	1	<p>Outlet Manifolds</p> <p>Materials of Construction: A36 carbon steel, ¼” thick and adequately stiffened to withstand maximum internal pressures.</p> <p>Operational Parameters: ±25 IWC (0.06 bar); 204°F (96°C) normal operating temperature; maximum operational temperature is 800°F (427°C) during bake-out and occurrence is for a duration of 15 minutes intervals.</p> <p>Access: One (1) man door for internal inspection.</p>
5.7.7	1	<p>Process Dampers</p> <p>Materials of Construction: Type 304L stainless steel for inlet side of RTO and A36 for discharge side of RTO.</p> <p>Type: Butterfly with tadpole seats.</p>
5.7.8	1	<p>ID Fan</p> <p>Temperature: 450°F design temperature (232°C).</p> <p>Static Pressure: 25 IWC (0.06 bar); includes additional pressure with 2 IWC (0.005 bar) for incoming duct loss</p>
5.7.9	1	<p>Exhaust Stack</p> <p>Materials of Construction: A36 carbon steel.</p> <p>Height: 50’ above grade.</p> <p>Features: Sampling platform per specifications, ladder from grade to platform, free standing</p>
5.7.10	1	<p>Internal Ceramic Refractory</p> <p>Heat Recovery Sections: Minimum 6” thick 8 lb density (15.24 cm thick @ 3.64 kg density).</p> <p>Combustion Chamber: Minimum 8” thick 8 lb density (20.32 cm thick @ 3.64 kg density).</p> <p>Type: Unifrax or approved equal; Anchor-Loc spun fiber ceramic modules.</p> <p>Attachment Method: Welded/threaded stud, Stainless steel.</p>

Pos	Units	Description
		Combustion Chamber Temperature: 1550°F (843°C). Maximum Internal Temperature: 2200°F (1204°C). External Skin Temperature: Less than 150°F (66°C) at 70°F (21°C) with 5 mph (8 km/hr) wind.
5.7.11	1	Heat Recovery Media Type: MLM structured media by Lantec or equal. Thermal Efficiency: 96.5% TE.
5.7.12	1	Burner System Type: Maxon Kinemax. Size: 8 mmBTU/hr each (8.44 Gj). (Total RTO rating) Quantity: Six (6) burners. Features: Maxon series 5000 blocking valves, Honeywell C6097 A series pressure switches, Actarus B 38 R pressure regulators, Maxon MicroRatio series air/gas proportioning valves, combustion blower, Honeywell RM 7800L flame supervisory system, Honeywell C7061 A self-checking flame scanner, and Honeywell UDC 2500 over temperature control; supplied pre-piped, pre-wired, skid mounted
5.7.13	1	RTO Control Devices The following devices are included in order to control the RTO via PLC: <ul style="list-style-type: none"> • Temperature Control Sensors • Temperature Transmitters • Zero Speed Switches • Pressure Transmitters • Proximity Switches (Capacitive and Inductive) • Flame Scanner(s)
5.7.14	1	Structures, supports and platforms All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passage ways needed for the correct inspection and maintenance of the installation. All the equipment (except those in inox steel) are supplied with a layer of epoxy covered by a layer of synthetic paint, according with our standard RAL

Pos	Units	Description
5.8	1	Drying Island: REFRACTORY WORKS
		<p>Supply all manpower, lifting and hoisting equipment, and travel and living expenses, to install the refractory on the Heat Energy System and connecting hot gas ductwork between the Heat Energy System and Dryer Drum.</p> <p>It includes:</p> <ol style="list-style-type: none"> 1) Heat Energy System refractory supply. 2) Heat Energy System refractory anchors supply. 3) Dryer System's hot gas ductwork refractory supply. 4) Dryer System's hot gas ductwork refractory anchor supply. 5) Heat Energy System anchor and refractory installation. 6) Dryer System hot gas ductwork anchor and refractory installation. 7) Heat Energy System refractory cure-out. 8) Dryer System refractory cure-out. 9) Refractory installation/cure-out 3rd party inspection. 10) Confined space area attendants and monitors.

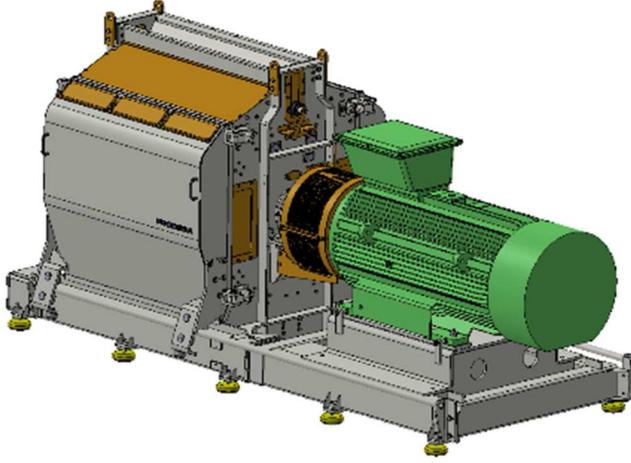
Pos.	Units	Description								
5.9		DRY PRODUCT STORAGE								
5.9.1	1	<p>Chain conveyor Moves the dry product from the dryer to the intermediate storage silo.</p> <p><u>Technical data:</u></p> <table> <tr> <td>Length</td> <td>154 ft (47 m)</td> </tr> <tr> <td>Inclination</td> <td>22°</td> </tr> <tr> <td>Installed power</td> <td>18.5 kW (25 HP)</td> </tr> <tr> <td>Material</td> <td>SS</td> </tr> </table>	Length	154 ft (47 m)	Inclination	22°	Installed power	18.5 kW (25 HP)	Material	SS
Length	154 ft (47 m)									
Inclination	22°									
Installed power	18.5 kW (25 HP)									
Material	SS									
5.9.2	1	<p>Screw conveyor It receives the dry product from the previous chain conveyor (pos 5.9.1) and discharges it into the dry product silo. It includes a second outlet as emergency exit..</p> <p><u>Technical data:</u></p> <table> <tr> <td>Length</td> <td>21 ft (6.5 m)</td> </tr> <tr> <td>Inclination</td> <td>0°</td> </tr> <tr> <td>Installed power</td> <td>7.5 kW (10 HP)</td> </tr> </table>	Length	21 ft (6.5 m)	Inclination	0°	Installed power	7.5 kW (10 HP)		
Length	21 ft (6.5 m)									
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5.9.3		<p>Intermediate storage vertical silo</p> <p><u>VERTICAL SILO:</u> Bolted carbon and carbon steel construction, delivered in prefabricated segments or parts for assembling on site.</p> <p>It consists of:</p> <ul style="list-style-type: none"> • Interior floor assembly with all assembling and connection openings • 4' x 4' opening in skirt as outlet for process conveyor • 4' x 4' opening in skirt as outlet for dump conveyor1 • 6' x 6'-8" Double Walk-Through Door in silo skirt1 • 36" x 48" maintenance opening at level of product floor • 4'-6" x 4'-6" exterior platform at level of product floor with access ladder and fall protection system • 1 set of explosion vents arranged underneath eave • 4 x eave mounted conveyor support columns, designed for max 10 kip vertical load each • Exterior ladder with fall protection system - OSHA Compliant – as access to silo roof, design with no cage and no rest platforms • Accessible roof (1:12) – self supported • 1 guardrail (full perimeter) • 4' square inlet flange on roof 								

Pos.	Units	Description																
		<ul style="list-style-type: none"> • 2'x 3' bin vent flange on roof • 24" roof combination manway pressure relief valve, 2.0 oz. pressure, 0.5 oz. vacuum with removable security cross • 2 x 4" dia., Flange (for level control (continuous), silo roof) • 4 x 2 1/2" dia. half coupling (for level control min, intermediate or max in silo roof or silo shell) • 1 fire suppression line w/ roof mounted nozzles (dry line system) <p><u>Silo Technical data:</u></p> <table> <tr> <td>Volume (gross)</td> <td>45,732 ft3 (1,295 m3)</td> </tr> <tr> <td>Volume (net), approx.</td> <td>35,456 ft3 (1,004 m3)</td> </tr> <tr> <td>Angle of repose</td> <td>45°</td> </tr> <tr> <td>Inner silo diameter</td> <td>33.85' (10.317 mm)</td> </tr> </table> <p>It includes a <u>ROTATING SCREW</u>:</p> <p>1 turret, supported in a heavy-duty rotary-joint, with external teeth system for transmission of the forward feed drive forces.</p> <p>2 rotating screw, support to one side in the silo center at the turret, screw spiral with progressive pitch, screw flights in special design; supported in a heavy-duty bevel helical gearbox.</p> <p>1 Drive unit for the screw spiral in multilevel design</p> <p>2 forward feed drive for rotation of the turret around the silo centreline</p> <p>1 support frame for assembly of the complete rotating screw unit into the silo bottom structure.</p> <p>1 level switch / overfilling protection in the lower part of the turret for automatic switch-off, in case of an unforeseen shutdown of the downstream conveyor below the rotating screw unit.</p> <p>1 sealing between turret and silo bottom.</p> <p><u>Rotating Screw Technical data:</u></p> <table> <tr> <td>Diameter</td> <td>33.85' (10,317 mm)</td> </tr> <tr> <td>Discharge rate</td> <td>11,000 ft3/h (311 m3/h)</td> </tr> <tr> <td>Installed power main drive</td> <td>45 kW (60 HP)</td> </tr> <tr> <td>Installed power forward device</td> <td>2 x 0.5 Kw (2 x 0.33 HP)</td> </tr> </table>	Volume (gross)	45,732 ft3 (1,295 m3)	Volume (net), approx.	35,456 ft3 (1,004 m3)	Angle of repose	45°	Inner silo diameter	33.85' (10.317 mm)	Diameter	33.85' (10,317 mm)	Discharge rate	11,000 ft3/h (311 m3/h)	Installed power main drive	45 kW (60 HP)	Installed power forward device	2 x 0.5 Kw (2 x 0.33 HP)
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5.9.4	1	<p>Diverter</p> <p>Installed at the dry product silo outlet, allows discharge the product:</p> <ul style="list-style-type: none"> • Outlet 1: Emergency Screw Conveyor • Outlet 2: Milling line feeding chain conveyor 																

Pos.	Units	Description
5.9.5	1	Emergency screw conveyor To empty the silo in case of emergency.
5.9.6	1	Milling line feeding chain conveyor To transport the dried product from the intermediate storage silo diverter (pos 5.9.4) to the dry hammer mills feeding chain conveyor (pos 5.10.1). <u>Technical data:</u> Length 126 ft (38.5 m) Inclination 20° Installed power 15 kW (20 HP)
5.9.7	1	Structures, supports and platforms All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passageways needed for the correct inspection and maintenance of the installation.

Pos	Units	Description						
5.10		DRY MILLING LINE						
5.10.1	1	<p>Dry hammer mills feeding chain conveyor</p> <p>It receives the product from the previous conveyor (pos 5.9.6) and feeds the dry hammer mills.</p> <p>Double bottom chain conveyor so it is possible to feed the hammer mills and the leftover will be discharged to a second conveyor (pos 5.10.8) to return it to the dry product storage silo (pos 5.9.3)</p> <p><u>Technical data:</u></p> <table border="0"> <tr> <td>Length</td> <td>108 ft (33 m)</td> </tr> <tr> <td>Inclination</td> <td>0°</td> </tr> <tr> <td>Installed power</td> <td>15 kW (20 HP)</td> </tr> </table>	Length	108 ft (33 m)	Inclination	0°	Installed power	15 kW (20 HP)
Length	108 ft (33 m)							
Inclination	0°							
Installed power	15 kW (20 HP)							
5.10.2	4	<p>DHM Dosing bin with triple extracting screw</p> <p>Steel bin to collect the dry product and dose it to the hammer mill.</p> <p>It includes dosing screws with frequency converters. Driven by gear box directly mounted on the screw shaft.</p>						
5.10.3	4	<p>Destoner Rolston DRS 15</p> <ul style="list-style-type: none"> - Stone separator to evacuate heavy sizes (stones). - Permanent magnet to evacuate the metal pieces. - Suction pipe to introduce air in the hammer mill. <p><u>Technical data:</u></p> <table border="0"> <tr> <td>Dimensions</td> <td>47" x 39 " x 63"</td> </tr> <tr> <td>Weight</td> <td>1370 lbs</td> </tr> </table>	Dimensions	47" x 39 " x 63"	Weight	1370 lbs		
Dimensions	47" x 39 " x 63"							
Weight	1370 lbs							
5.10.4	4	<div style="text-align: right;">  </div> <p>Dry hammer mill THOR DHM 15</p> <p>Body and frame:</p> <ul style="list-style-type: none"> - A robust body made from welded steel which sits over the rotor - A single base frame for the body and motors - Suspension feet under the frame with height adjustment - A product deflector flap controlled manually at the inlet of hammer mill (two possible positions according to the rotational direction of the rotor) <p>Drive:</p> <ul style="list-style-type: none"> - Coupling is carried out by machined plates with semi-elastic cylindrical fingers (Mounted under protective guards) - Motor included: <table border="1" style="margin-left: 40px;"> <tr> <td>Motor</td> <td>900 HP</td> </tr> <tr> <td>Motor rpm</td> <td>1,500 rpm</td> </tr> </table>	Motor	900 HP	Motor rpm	1,500 rpm		
Motor	900 HP							
Motor rpm	1,500 rpm							

Pos	Units	Description																				
		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>Direct drive</td> </tr> </table> <p>Rotor:</p> <ul style="list-style-type: none"> - Big and heavy, mounted to two external roller bearings <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Diameter</td> <td>55"</td> </tr> <tr> <td>Width</td> <td>60"</td> </tr> </table> <ul style="list-style-type: none"> - Rotor rotational direction can be clock-wise or counter clock-wise <p>Screens</p> <ul style="list-style-type: none"> - The total screening surface is composed of 6 distinct sections (individual screens) <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Total surface area</td> <td>48 ft²</td> </tr> </table> <ul style="list-style-type: none"> - Internal impact zones are composed of removable plates, some of which are equipped with static counter-hammers - 1st set of screens (6) supplied with the hammer mill (diameter to be defined in further stages) - Screens are changed manually when the hammer mill is stopped <p>Hammers:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Units</td> <td>216 (1st set)</td> </tr> <tr> <td>Speed</td> <td>109 m/s</td> </tr> <tr> <td>Dimensions</td> <td>13" x 3" x 0.4"</td> </tr> <tr> <td>Weight</td> <td>4.6 lbs</td> </tr> </table> <p>Access doors:</p> <ul style="list-style-type: none"> - Two access doors on each side of the machine; each equipped with electric security locks <p>An electrical terminal block for the connection of various sensors (pre-wired in our workshop):</p> <ul style="list-style-type: none"> - Two electromechanical limit switches confirming the position of the inlet deflector flap - Vibration sensor mounted to one of the side plates - Temperature sensors on the bearings <p>Tools for hammer mill maintenance:</p> <ul style="list-style-type: none"> - Set of anti-drop steel plates (to prevent anything from falling under the hammer mill during maintenance) <p><u>Additional technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Inlet opening</td> <td style="text-align: right;">12" x 60.9"</td> </tr> <tr> <td>Self-propelled air</td> <td style="text-align: right;">14,714 CFM (25,000 Nm³/h)</td> </tr> </table>		Direct drive	Diameter	55"	Width	60"	Total surface area	48 ft ²	Units	216 (1 st set)	Speed	109 m/s	Dimensions	13" x 3" x 0.4"	Weight	4.6 lbs	Inlet opening	12" x 60.9"	Self-propelled air	14,714 CFM (25,000 Nm ³ /h)
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Pos	Units	Description
		<p>Total weight (without motor) 7.850 kg</p> 
5.10.5	4	<p>Dry hammer mill PLENUM CHAMBER and PNEUMATIC SYSTEM</p> <p>It includes:</p> <ul style="list-style-type: none"> • <u>PLENUM CHAMBER</u> <p>The milled product is discharged by gravity in a discharge hopper. It includes:</p> <ul style="list-style-type: none"> ○ <u>Back pressure flaps:</u> <p>Equipment which prevents the transmission of the dangerous effects of an explosion, a pressure wave and flames before the filter. It prevents too the dust returns when the installation is stopped.</p> ○ <u>Extracting chain conveyor</u> ○ <u>Rotary valve</u>, for the pneumatic sealing of the hammer mill circuit. • <u>PNEUMATIC SYSTEM</u> <p>It includes the ducting (from plenum chamber to inlet cyclofilter, outlet cyclofilter to fan) cyclofilter with explosion panels, valves, exhaust fan and stack:</p> <ul style="list-style-type: none"> ○ Ducting ○ Explosion isolation valve, to be installed at the inlet duct, with micro switch and dust level sensor

Pos	Units	Description						
		<ul style="list-style-type: none"> ○ Cyclofilter, with explosion venting and explosion vent burst indicators. 232 filter bags that provide 2,413 square feet of media for 15,000 CFM airflow. ○ 48” Bottom hopper with screw conveyor + 12” NFPA Rotary valve ○ Fan 75 HP ○ Cyclofilter platform/ladder 						
5.10.6	1	<p>Spark detector and extinguishing system</p> <p>To be installed in the ducts of the pneumatic systems of each hammer mill, it includes the following devices:</p> <ul style="list-style-type: none"> • Spark detection central (one unique and common for all the different lines) <p>For the connection of the detecting instruments (upgradeable)</p> <p>It registers the all the events: alarms, number of sparks, sparks threshold, time threshold, extinguishing time.</p> <p>Microprocessor with an automatic control system.</p> <ul style="list-style-type: none"> • Spark detectors • Extinghisihing devices • Flashing alarm hor 						
5.10.7	1	<p>Dry and milled product chain conveyor</p> <p>It receives the product from the dry hammer mills and discharges into pelleting line feeding chain conveyor (pos. 5.11.6).</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Length</td> <td style="text-align: right;">197 ft (60 m)</td> </tr> <tr> <td>Inclination</td> <td style="text-align: right;">0º - 21º</td> </tr> <tr> <td>Installed power</td> <td style="text-align: right;">18.5 kW (25 HP)</td> </tr> </table>	Length	197 ft (60 m)	Inclination	0º - 21º	Installed power	18.5 kW (25 HP)
Length	197 ft (60 m)							
Inclination	0º - 21º							
Installed power	18.5 kW (25 HP)							
5.10.8	1	<p>Dry product recirculation chain conveyor</p> <p>It receives the product from the dry hammer mills feeding chain conveyor pos 5.10.1 to be introduced again in the dry product storage silo</p> <p><u>Technical data:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 70%;">Length</td> <td style="text-align: right;">123 ft (37.5 m)</td> </tr> <tr> <td>Inclination</td> <td style="text-align: right;">16º</td> </tr> <tr> <td>Installed power</td> <td style="text-align: right;">15 kW (20 HP)</td> </tr> </table>	Length	123 ft (37.5 m)	Inclination	16º	Installed power	15 kW (20 HP)
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Pos	Units	Description
5.10.9	1	<p>Support structures and painting</p> <p>Metal structures necessary for the support of described equipment, as well as access stairs and walkways required for the inspection and maintenance of the facility.</p> <p>All items (except stainless and galvanized steel) are supplied with a first coat of synthetic painting according to our standard RAL.</p>

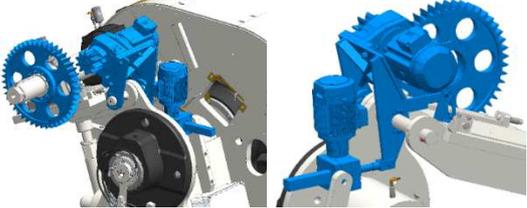
Pos.	Units	Description
5.11		DRY & MILLED PRODUCT STORAGE
5.11.1	1	<p>Chain conveyor</p> <p>Moves the leftover dry and milled product from the pelleting line, to the dry and milled product storage.</p> <p><u>Technical data:</u></p> <p>Length 164 ft (50 m) Inclination 0° - 25° Installed power 18.5 kW (25 HP)</p>
5.11.2	1	<p>Screw conveyor</p> <p>It receives the dry and milled product from the previous chain conveyor (pos 5.11.1) and discharges it into the dry and milled product silo. It includes a second outlet as emergency exit..</p> <p><u>Technical data:</u></p> <p>Length 21 ft (6.5 m) Inclination 0° Installed power 7.5 kW (10 HP)</p>
5.11.3	1	<p>Intermediate storage vertical silo</p> <p><u>VERTICAL SILO:</u> Bolted carbon and carbon steel construction, delivered in prefabricated segments or parts for assembling on site.</p> <p>It consists of:</p> <ul style="list-style-type: none"> • Interior floor assembly with all assembling and connection openings • 4' x 4' opening in skirt as outlet for process conveyor • 4' x 4' opening in skirt as outlet for dump conveyor1 • 6' x 6'-8" Double Walk-Through Door in silo skirt1 • 36" x 48" maintenance opening at level of product floor • 4'-6" x 4'-6" exterior platform at level of product floor with access ladder and fall protection system • 1 set of explosion vents arranged underneath eave • 4 x eave mounted conveyor support columns, designed for max 10 kip vertical load each • Exterior ladder with fall protection system - OSHA Compliant – as access to silo roof, design with no cage and no rest platforms • Accessible roof (1:12) – self supported • 1 guardrail (full perimeter)

Pos.	Units	Description																
		<ul style="list-style-type: none"> • 4' square inlet flange on roof • 2'x 3' bin vent flange on roof • 24" roof combination manway pressure relief valve, 2.0 oz. pressure, 0.5 oz. vacuum with removable security cross • 2 x 4" dia., Flange (for level control (continuous), silo roof) • 4 x 2 1/2" dia. half coupling (for level control min, intermediate or max in silo roof or silo shell) • 1 fire suppression line w/ roof mounted nozzles (dry line system) <p><u>Silo Technical data:</u></p> <table> <tr> <td>Volume (gross)</td> <td>45,732 ft3 (1,295 m3)</td> </tr> <tr> <td>Volume (net), approx.</td> <td>35,456 ft3 (1,004 m3)</td> </tr> <tr> <td>Angle of repose</td> <td>45°</td> </tr> <tr> <td>Inner silo diameter</td> <td>33.85' (10.317 mm)</td> </tr> </table> <p>It includes a <u>ROTATING SCREW</u>:</p> <p>1 turret, supported in a heavy-duty rotary-joint, with external teeth system for transmission of the forward feed drive forces.</p> <p>2 rotating screw, support to one side in the silo center at the turret, screw spiral with progressive pitch, screw flights in special design; supported in a heavy-duty bevel helical gearbox.</p> <p>1 Drive unit for the screw spiral in multilevel design</p> <p>2 forward feed drive for rotation of the turret around the silo centreline</p> <p>1 support frame for assembly of the complete rotating screw unit into the silo bottom structure.</p> <p>1 level switch / overfilling protection in the lower part of the turret for automatic switch-off, in case of an unforeseen shutdown of the downstream conveyor below the rotating screw unit.</p> <p>1 sealing between turret and silo bottom.</p> <p><u>Rotating Screw Technical data:</u></p> <table> <tr> <td>Diameter</td> <td>33.85' (10,317 mm)</td> </tr> <tr> <td>Discharge rate</td> <td>12,361 ft3/h (350 m3/h)</td> </tr> <tr> <td>Installed power main drive</td> <td>45 kW (60 HP)</td> </tr> <tr> <td>Installed power forward device</td> <td>2 x 0.25 Kw (2 x 0.33 HP)</td> </tr> </table>	Volume (gross)	45,732 ft3 (1,295 m3)	Volume (net), approx.	35,456 ft3 (1,004 m3)	Angle of repose	45°	Inner silo diameter	33.85' (10.317 mm)	Diameter	33.85' (10,317 mm)	Discharge rate	12,361 ft3/h (350 m3/h)	Installed power main drive	45 kW (60 HP)	Installed power forward device	2 x 0.25 Kw (2 x 0.33 HP)
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5.11.4	1	<p>Diverter</p> <p>Installed at the dry product silo outlet, allows discharge the product:</p> <ul style="list-style-type: none"> • Outlet 1: Emergency Screw Conveyor • Outlet 2: Pelleting line feeding chain conveyor 																

Pos.	Units	Description
5.11.5	1	Emergency screw conveyor To empty the silo in case of emergency.
5.11.6	1	Pelleting line feeding chain conveyor To transport the dried product from the intermediate storage silo diverter (pos 5.11.3) to the two pelleting lines. <u>Technical data:</u> Length 161 ft (49 m) Inclination 11° - 0° Installed power 11 kW (15 HP)
5.11.7	1	Pelleting line 1 Screw conveyor It receives the product from the pelleting line feeding chain conveyor (pos 5.11.6) and feeds the pelleting line 1. To control de product flow that is fed to each pelleting line.
5.11.8	1	Structures, supports and platforms All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passageways needed for the correct inspection and maintenance of the installation.

Pos.	Units	Description
5.12	1	PELLETING LINE
5.12.1	2	<p>Pellet mills feeding chain conveyor</p> <p>Double bottom chain conveyor that collect the product from the previous conveyors (pos 5.11.6 for one pelleting line and pos 5.11.7 for the other pelleting line) to feed the pellet mills. The leftover returns to the dry & milled product silo through the chain conveyor pos 5.11.1.</p> <p><u>Technical data/UNIT</u></p> <p>Length 78.7 ft (24 m) Inclination 0° Installed power 5.5 kW (7.5 HP)</p>
5.12.2	12	<p>Feeding dosing screw FS 1 x 3.0 </p> <p>To dose the product into the pellet mill through frequency converter^[1]</p> <p>Driven by gearbox</p> <p><u>Technical data:</u></p> <p>Diameter of screw 12" Length 6.5 ft Material AISI 304 stainless steel Electrical installed power 2.2 Kw (3 HP) By variable Frequency Drive (optional)</p>
5.12.3	12	<p>Conditioner CD 45 </p> <p>For a correct conditioning of the product before the pelletizing, through water addition.</p> <p>Rotor with 50 adjustable and detachable paddles made of stainless steel</p> <p>Inspection door with safety magnetic detector</p> <p>PT 100 sensor</p> <p>Driven by gearbox</p> <p><u>Technical data:</u></p> <p>Material Stainless steel Length 87" Volume 12.5 ft³ Conditioner rotation 500 rpm Inlet water flange diameter 10 mm Electrical installed power (each) 10 HP Full Voltage</p>

Pos.	Units	Description														
5.12.4	12	<p>Pellet mill TORO PM 8.1 </p> <p>Pellet mill designed for wood pelleting with a vertically mounted ring die.</p> <p>Body and frame</p> <ul style="list-style-type: none"> - Made from welded steel - Designed to position the motor at the rear of the pellet mill - Anti-vibrational plates placed between the pellet mill body and the floor - Equipped with 4 cantilever plates on each frame according to the Prodesa design <p>Main shaft mechanical assembly</p> <ul style="list-style-type: none"> - Hollow main shaft – made from cast iron - Main pulley made from a special cast iron, mounted onto heavy duty high quality bearings - Safety pin calibrated according to motor power <p>Secondary shaft</p> <ul style="list-style-type: none"> - Mounted to two bearings with housing support <p>Drive / transmission</p> <ul style="list-style-type: none"> - Main drive – XPC V-belt transmission – under protective guard designed according to Prodesa standard - Secondary drive – Toothed belt transmission – enclosed in the pellet mill body - Motor included: <table border="1" data-bbox="587 1267 1083 1373"> <tr> <td>Motor</td> <td>500 HP</td> </tr> <tr> <td>Motor rpm</td> <td>1,800 rpm</td> </tr> </table> <p>Compression</p> <ul style="list-style-type: none"> - A conical bowl to distribute the product entering via the feeding chute - Scrapers to help guide the product between the rolls and inner die surface - Ring die (ESR) – see note below <ul style="list-style-type: none"> o Dismantled via a thermo-mechanical system <table border="1" data-bbox="587 1592 1139 1854"> <tr> <td>Working width</td> <td>4"</td> </tr> <tr> <td>Inner diameter</td> <td>32"</td> </tr> <tr> <td>Working surface</td> <td>3 ft² (432 in²)</td> </tr> <tr> <td>Pellet diameter</td> <td>6-8 mm</td> </tr> <tr> <td>Rotation speed</td> <td>91 rpm</td> </tr> </table>	Motor	500 HP	Motor rpm	1,800 rpm	Working width	4"	Inner diameter	32"	Working surface	3 ft ² (432 in ²)	Pellet diameter	6-8 mm	Rotation speed	91 rpm
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Pos.	Units	Description						
		<ul style="list-style-type: none"> - Two corrugated rollers (ED) - Micrometric adjustment (Low grease consumption) <table border="1"> <tr> <td>Units</td> <td>2</td> </tr> <tr> <td>Outer diameter</td> <td>15,3"</td> </tr> <tr> <td>Working width</td> <td>4"</td> </tr> </table> <p>Main door and hinged feeding chute</p> <ul style="list-style-type: none"> - Made of stainless steel - Door opening to the left or right (reversible) - Mechanical safety locks for both the main door and hinged chute (opening to the right). To be connected to the local control cabinet (deported electronics) - Opening on door with butterfly flap for steam extraction <p>An electrical box to connect the sensors and probes (Pre-wired in our workshop)</p> <ul style="list-style-type: none"> - Temperature probes for the secondary shaft bearings - Vibration control probes placed on the secondary shaft bearing housing - Speed control and module counting of the main pulley - Cooling fan for the toothed belts - Safety pin rupture sensor <p><u>Additional data:</u></p> <p>Weight 26,500 lbs</p>	Units	2	Outer diameter	15,3"	Working width	4"
Units	2							
Outer diameter	15,3"							
Working width	4"							
5.12.5	12	<p>Slow die rotation system</p> <p>To be able to work with the die turning bidirectional at low speed and during maintenance operations and adjustments.</p> <p>Mechanical system which allows to work with the die turning at low speed during the maintenance operation and adjustments. It means a greater operator safety.</p> <p>It allows to reduce the speed from 91 rpm to 1 rpm.</p>  <p><u>Technical data:</u></p> <p>Rotation speed with slow rotation system 1 rpm Electrical installed power (each) 4 HP (3 Kw) Variable Frequency Drive</p>						
5.12.6	12	<p>Water injection system</p>						

Pos.	Units	Description
5.12.7	12	Pellet mill lubrication system
5.12.8	2	<p>Tool kit</p> <p>For the pellet mills maintenance. It includes:</p> <ul style="list-style-type: none"> • <u>Set of tools</u> <p>Tool set used to perform all maintenance and adjustments on the pellet mill: special hoop for die handling, reinforced front hoop, small tools for bolts dismounting, tension gauge (laser tensiometer)</p> <ul style="list-style-type: none"> • <u>Thermal system for die mounting</u> <p>Thermo-mechanical system using heating belts to heat up and dilate the front hoop and floor bearing to remove and replace the die.</p> <ul style="list-style-type: none"> ○ Heating belt composed of two half-rings equipped with resistors and a thermocouple ○ Power: 2 x 12 kW – 380 V – 50 Hz ○ Electrical control cabinet mounted to a mobile trolley <ul style="list-style-type: none"> • <u>Trolley for die and rollers maintenance and replacement</u> <p>Die and roll handling system. One trolley can be used for a park of several machines. Hooks to lift die and rollers (for crane trolley, the equipment has been controlled and certified for safety use under indicated working conditions.</p> <ul style="list-style-type: none"> ○ Manual trolley for 1100 kg load ○ Double effect pump
5.12.9	12	By-pass at the pellet mills outlet
5.12.10	2	<p>Demister circuit</p> <p>It collects the mist produced during the pelletizing process into the pellet mills. The mist will transport air and solid particles.</p> <p>The mist flow is transported through a channel with a hollow screw which takes out the solid particles.</p> <p>A special outlet gate unloads the refuse product on a container.</p>
5.12.11	2	<p>Hot pellets chain conveyor</p> <p>To collect the pellets at the outlet of the pellet mills and discharges them into the hot pellets bucket elevator</p>

Pos.	Units	Description
5.12.17	1	<p>Fines and broken pellets collecting conveyor 2</p> <p>To collect fines and broken pellets from the previous conveyor (pos 5.12.7) and discharges it into the dry product silo.</p> <p><u>Technical data:</u></p> <p>Length 151 ft (46 m) Inclination 15° Installed power 45 kW (60 HP)</p>
5.12.18	1	<p>Spark detector and extinguishing system</p> <p>To be installed in the following points:</p> <ul style="list-style-type: none"> - 1 x Outlet of hot pellets bucket elevator - 1 x Pneumatic system of the coolers <p>It includes the following devices:</p> <ul style="list-style-type: none"> • Spark detection central (one unique and common for all the different lines) <p>For the connection of the detecting instruments (upgradeable)</p> <p>It registers the all the events: alarms, number of sparks, sparks threshold, time threshold, extinguishing time.</p> <p>Microprocessor with an automatic control system.</p> <ul style="list-style-type: none"> • Spark detectors • Extinghisihing devices • Flashing alarm horn
5.12.19	1	<p>Structures, supports and platforms</p> <p>All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passageways needed for the correct inspection and maintenance of the installation.</p>

Pos	Units	Description
5.13	1	Milling and Pelleting Island RTO (RCO correction)
5.13.1	1	<p>Inlet manifold</p> <p>Materials of Construction: Type 304L stainless steel, with minimum 10-gauge thickness, adequately stiffened to withstand maximum internal pressures. Operational Parameters: ±25 IWC; 176°F (0.06 bar @ 80°C). Access: One access door for internal inspection of inlet manifold.</p>
5.13.2	1	<p>Diverter Valves</p> <p>Materials of Construction: Type 304L stainless steel 3/16 in. thick and adequately stiffened to withstand maximum internal pressures. Operational Parameters: ±25 IWC; 176°F (0.06 bar @ 80°C)inlet and 209°F outlet (98°C); maximum operational temperature is 600°F (316°C) during bake-out, and occurrence is for duration of 15-minute intervals. Valve Trim Construction: Main disk 3/16-inch-thick, Type 2101 duplex stainless steel; support disks 3/16-inch-thick Type 304L stainless steel. Seat materials are Type 304L stainless steel. Seal arrangement is metal to metal sealing surfaces without elastomeric compounds that would damage during bake-out. Access: One access door for internal inspection. Valve Actuation System: Parker 2A heavy duty pneumatic cylinder, adjustable end cushions at each end of travel; direct link with Parker linear alignment coupling, inductive proximity switches measuring actual valve shaft position, actuation time is 0.5 seconds full open to full close; the assembly is pre-assembled and pre-wired to junction box.</p>
5.13.3	1	<p>Hopper Transitions</p> <p>Materials of Construction: Type 304 stainless steel 3/16-inch-thick and adequately stiffened to withstand maximum internal pressures. Operational Parameters: ±25 IWC; 176°F (0.06 bar @ 80°C) inlet and 209°C outlet (98°C); maximum operational temperature is 600°F (316°C) during bake-out</p>
5.13.4	1	<p>Heat Recovery Sections</p> <p>Materials of Construction: Type 304L stainless steel 3/16-inch-thick and adequately stiffened to withstand maximum internal pressures Operational Parameters: ±25" IWC (0.06 bar); 176°F (80°C) inlet and 1500°F outlet (816°C); maximum operational temperature 1800°F (982°C) at top and 1100°F (593°C) at bottom. Media Support Structure: Type 304 stainless steel structure with laser cut slotted plate; maximum design temperature of 1100°F (593°C); maximum free passage of 70% open area; centered in heat recovery chamber with no direct contact to outside walls; both ends floating to allow for thermal expansion.</p>

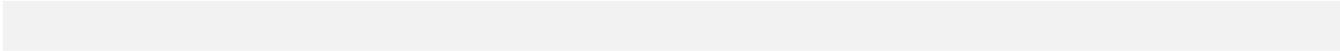
Pos	Units	Description
		Access: Inspection access to the support structures is through the diverter valve; inspection access to top of heat recovery section is through combustion chamber access .
5.13.5	1	<p>Combustion Chamber</p> <p>Materials of Construction: Type 304L stainless steel 3/16-inch-thick and adequately stiffened to withstand maximum internal pressures.</p> <p>Operational Parameters: ±25 IWC (0.06 bar); normal operation 1500°F (816°C); maximum operational temperature 1800°F (982°C).</p> <p>Access: One access door in the combustion chamber.</p>
5.13.6	1	<p>Outlet Manifolds</p> <p>Materials of Construction: A36 carbon steel, ¼” thick and adequately stiffened to withstand maximum internal pressures.</p> <p>Operational Parameters: ±25 IWC (0.06 bar); 204°F (96°C) normal operating temperature; maximum operational temperature is 800°F (427°C) during bake-out and occurrence is for a duration of 15 minutes intervals.</p> <p>Access: One (1) man door for internal inspection</p>
5.13.7	1	<p>Process Dampers</p> <p>Materials of Construction: Type 304L stainless steel for inlet side of RTO and A36 for discharge side of RTO.</p> <p>Type: Butterfly with tadpole seats..</p>
5.13.8	1	<p>ID Fan</p> <p>Static Pressure: 25 IWC (0.06 bar); includes additional pressure with 2 IWC (0.005 bar) for incoming duct loss</p>
5.13.9	1	<p>Exhaust Stack</p> <p>Materials of Construction: A36 carbon steel.</p> <p>Features: Sampling platform per specifications, ladder from grade to platform, free standing</p>
5.13.10	1	<p>Internal Ceramic Refractory</p> <p>Heat Recovery Sections: Minimum 6” thick 8 lb density (15.24 cm thick @ 3.64 kg density).</p> <p>Combustion Chamber: Minimum 8” thick 8 lb density (20.32 cm thick @ 3.64 kg density).</p> <p>Type: Unifrax or approved equal; Anchor-Loc spun fiber ceramic modules.</p> <p>Attachment Method: Welded/threaded stud, Stainless steel.</p> <p>Combustion Chamber Temperature: 1550°F (843°C).</p> <p>Maximum Internal Temperature: 2200°F (1204°C).</p>

Pos	Units	Description
		External Skin Temperature: Less than 150°F (66°C) at 70°F (21°C) with 5 mph (8 km/hr) wind.
5.13.11	1	Heat Recovery Media Type: MLM structured media by Lantec or equal. Thermal Efficiency: 96.5% TE.
5.13.12	1	Burner System Type: Maxon Kinemax. Features: Maxon series 5000 blocking valves, Honeywell C6097 A series pressure switches, Actarus B 38 R pressure regulators, Maxon MicroRatio series air/gas proportioning valves, combustion blower, Honeywell RM 7800L flame supervisory system, Honeywell C7061 A self-checking flame scanner, and Honeywell UDC 2500 over temperature control; supplied pre-piped, pre-wired, skid mounted.
5.13.13	1	RTO Control Devices The following devices are included in order to control the RTO via PLC: <ul style="list-style-type: none"> • Temperature Control Sensors • Temperature Transmitters • Zero Speed Switches • Pressure Transmitters • Proximity Switches (Capacitive and Inductive) • Flame Scanner(s)
5.13.14	1	Structures, supports and platforms All the metallic structures for the sustentation of the described equipment, the access ladders and platforms and passage ways needed for the correct inspection and maintenance of the installation. All the equipment (except those in inox steel) are supplied with a layer of epoxy covered by a layer of synthetic paint, according with our standard RAL

Pos.	Units	Description
5.14		Electrical equipment and control system
5.14.1	1	<p>Control system</p> <ul style="list-style-type: none"> • Automatic process control. In order to control and regulate the plant, a PLC (Siemens S7-300, S7-1500 or similar), with visualization and trending, is supplied. For maintenance and regulation of every equipment, it exists the possibility of controlling them in a manual mode. • Independent control systems in dry line and pellet line. In this way, for maintenance, it can be possible to disconnect completely one line, whereas the other one can continue operating. • There are instrumentation control inputs and outputs in electrical cabinets, which are located near the equipment. These inputs and outputs include IP 54 protection in order to reduce the cabling and to avoid interferences. • Local control electrical cabinets for the main equipment, such as mills and pellet mills. • Communication between electrical cabinets by Profibus, Profinet or CANopen. Ring layout in order to guarantee a better performance. • Double communications card. The first one to ensure SCADA communications and the other one to control inputs/outputs. • Safety controllers to manage the general emergency stop and the safety circuits of main equipment. • Internet connection for remote maintenance to be supplied by client. • Process instrumentation: IFM, Edress Hauser, Wika, Schmersall, ACO, etc.
5.14.2	1	<p>Monitoring System</p> <ul style="list-style-type: none"> • Monitoring system PC-SCADA, based on WinCC, Cimplicity or similar. • PC in Rack with constant supply, SAI. • Rack of connecting PC-SCADA, SAI and Switch of Ethernet connections. • Redundant hard disks. • Display system in several monitors at the same time. Thanks to it, it can be possible to display the whole plant state in a simple way. • Display of process parameters, input data and state of the sequence. • Functioning and operation control, with the equipment working in a manual mode. • Graphs and functioning records. In this way, it can be possible to visualize current trends or recover old records in order to analyze them. • Display active alarms and record them in the long-term. • Internet connection for remote maintenance to be supplied by client.

Pos.	Units	Description
5.14.3	1	<p>Electrical Power Cabinet</p> <ul style="list-style-type: none"> • Control and protection of motors and drives. • Cutoff switch with protection against overcurrents and differential failure. • Network analyzer integrated with record and display of data from SCADA. • Direct starter for motors (P ≤ 7,5 kW), Siemens, ABB or similar. • Slow starter for motors (P >7,5 kW or less if it is required for the process), Siemens, ABB or similar. • High performance frequency variators. It is possible to add a line filter for drivers if the process requires it. ABB, Siemens or similar. • Control panels for the starters and variators. They are located in the frontal part of the electrical cabinet, in this way you can manipulate them without opening the cabinet. • Variators and starters communicated with the PLC by Profibus, Profinet, etherCAN or similar. • Terminal connection on the bottom of the electrical cabinet for areas under 35 mm². If the area is higher than 35 mm², the connection takes place in the driver shovel. <p><i>The cabling of all the elements described in this offer to the control panel is not included.</i></p>

Pos.	Units	Description
5.15		Engineering, Documentation and Project Management
5.15.1	1	<p>Engineering and Documentation</p> <p>The following documentation in English language is included in the price:</p> <ul style="list-style-type: none"> ✓ Loading drawing. ✓ Layout drawing. ✓ Electrical drawing. ✓ Motor and instrument list. ✓ P&ID. ✓ Operating instructions. ✓ List of spare parts. <p>Project Management</p> <p>Remote services of a Prodesa’s Project Manager to coordinate the different stages of engineering, manufacturing, shipping, erection supervision and commissioning.</p> <p>Includes monthly visits during the engineering stage to coordinate the Balance of Plant (Building, civil works, utilities, etc.) with the client and contractors.</p>



6. TRANSPORT, ERECTION SUPERVISION, COMMISSIONING

6.1 TRANSPORT

Prices are considered as DDP Hoquiam, Grays Harbor County (Washington, USA) according to INCOTERMS 2020 and in accordance with applicable duties, taxes and other costs related to import, in force at the moment of issuance of this offer.

In case of modifications on these costs:

- During the validity period of the offer or
- In case of project execution: during the period between the date of contract signature and the delivery date of the last material.

PRODESA reserves its right to revise the price of this DDP transport cost.

6.2 ERECTION SUPERVISION

The erection supervision by a wide experienced chief is included in our scope of supply.

We have included in the scope of this offer the services of three-four (3-4) experienced technicians during six (6) months to support the erection/assembly.

The electrical and mechanical erection will be done with local fitters. The cost of those fitters is not included in this offer.

Additionally services will be “per diem” rates.

NOTE: Our works on site include all the travel expenses, the accommodation and the subsistence allowances of our technicians.

6.3 COMMISSIONING

The commissioning consists on a cold start-up followed by a warm start-up. Our engineers will be onsite as required in order to carry out this operation.

The client will supply the utilities that will be specified before the commissioning.

For the commissioning, we have included the services of three (3) experienced technicians during four (4) months that will set the plant into operation and will train the staff.

Additionally services will be “per diem” rates.

The cold start-up phase is defined as all tasks and checks carried out in the equipment in dynamic and energized conditions (without raw material) in order to prepare the plant for the warm start-up (with product).

The end of the warm start-up is defined as the moment when the plant starts to produce pellets, so the Take Over. At this time, operational risks of the pellets plant is transferred to the client.

The training of the client’s staff will be in English language. The training will be together to the commissioning.

NOTE: Our works on site include all the travel expenses, the accommodation and the subsistence allowances of our technicians.

7. SUPPLY LIMITS

Product inlet

Ground chips:	Truck dumper	(pos. 5.1.2)
Shavings and sawdust	Truck dumper	(pos. 5.1.2)
Fuel	Truck dumper	(pos 5.1.2)

Product outlet

Pellets:	Pellet sifter	(pos. 5.12.15)
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Thermal energy

Fuel :	Truck dumper	(pos 5.1.2)
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Electricity

Electrical connection in our control panel.

Water

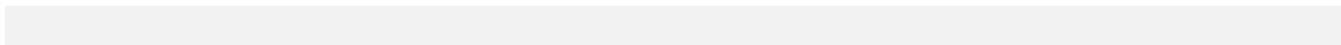
Inlet water flanges to the different consumption points.

Compressed air

Connections of different air consumption points: filters, coolers, etc.

Lubricant

Connections of different lubricant consumption points.



8. PRICE

As this is a budget proposal, prices and scope of supply may be altered in further discussions with the client.

Prices are given in USD.

POS.	DESCRIPTION	PRICE
5.1	Raw material reception	
5.2	Wet milling line	
5.3	Dryer feeding system	
5.4	Drying island – Drum dryer	
5.5	Drying island – Heat energy System	
5.6	Drying island – Wet electrostatic precipitator (WESP)	
5.7	Drying island – Regenerative thermal oxidizer (RTO)	
5.8	Drying island – Refractory works	
5.9	Dry product storage	
5.10	Dry milling line	
5.11	Dry and milled product storage	
5.12	Pelleting line	
5.13	Dry milling and pelleting island RTO	
5.14	Electrical equipment and control system	
5.15	Engineering, Documentation and Project Management	
6.1	Transport (DDP Delivery)	
6.2-6-3	Erection Supervision and Commissioning	
	TOTAL	

VAT and taxes not included.

9. TERMS OF PAYMENT

First payment: 30% at the signature of the contract.

The rest of the payments: 70%

Resting 70 % will be done by Partial or Total Transferable and Irrevocable Letter of Credit, in these stages:

- 50% at the delivery of the main equipment, by divided payments in each partial delivery of main equipment.
- 10 % at the end of the mechanical erection.
- 5 % at the end of the cold start-up.
- 5% at the end of the warm start-up.

The following sentences are applicable to the Letter of Credit or any other terms of payment agreed with the client:

- It must be emitted not later than one (1) month after the first payment is done. In case of delay in the emission of this Letter of Credit, the project will be delayed in proportional time or higher depending on the circumstances of the manufacturing.
- In case of delay in the delivery of the equipment, erection or commissioning due to circumstances beyond PRODESA's control, will invoice the corresponding pending stages of the LC in 15 days of our communication to execute the works.

10. PRICE VALIDITY

This offer is valid for 1 month from the date of issuance.

11. DELIVERY TIME

To be confirmed.

12. NOT INCLUDED

Unless especially mentioned in our quotation, the following parts and services are not included in our price:

1. Building with concrete, foundations and civil works, and Building construction, painting and demolition works possibly necessary on existing buildings
2. Based plates.
3. Cabling from the different elements described in the contract to the electrical panels.
4. Manpower for mechanical and electrical erection.
5. Cranes, scaffolding and other elevating devices necessary for the erection and offloading.
6. Thermal and acoustic isolation or reduction equipment (if required and not mentioned).
7. Grounding, Grounding network and bonding grid.
8. Reactive energy compensation.
9. Harmonics reduction system.
10. Ducting for compressed air, water, steam etc.
11. Air compressor, water pumps, etc.
12. Heat trace cables.
13. Piping insulation.
14. Pipe bridges.
15. Spare parts and parts subject to wear.
16. Radiographs of welds.
17. Protecting measures for electrical motors installed outdoor.
18. Required operating materials (pressurised air, water, electricity, lubricants, hydraulic oil, etc.) and disposal of the same
19. Operating material or fuels for commissioning test running and/or performance testing.
20. Energy and electrical cabinets during the erection and commissioning.
21. Toilets, changing rooms, and material storage room during the work.
22. Containers and management of the waste generated during the assembly and start up.
23. Containers for rejected product (overs, fines, metals, heavy particles...).
24. The cost of testing, third parties certifications and adaptations to regulations different to the ones considered, as local regulations for example. There is no provision for technical support to these adaptations in case of required.
25. Expenses for tests, stamps and approvals eventually requested by the authority in the country of destination.
26. Emissions and noise tests.
27. Registration with the Local Authority.
28. Any travel expenses, accommodation, allowances, etc, derived from mandatory quarantines due to COVID19 (If applicable at time of travel). These costs will be invoiced according to Prodesa's Administration fares
29. All other services and supplies not mentioned in our description.

13. ANNEX

Annex 1	General Conditions of Sales	F.82.01.04 - ANNEX I, GCS
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