

SECTION 5A – Subsection 5: Technical Specifications of Treatment Facilities

Table of Contents

TABLE OF CONTENTS.....	1
5 TECHNICAL SPECIFICATIONS OF TREATMENT FACILITY	7
5.1 MSW MECHANICAL PRE-TREATMENT FACILITY TECHNICAL SPECIFICATIONS	7
5.1.1 Crane Bridge – Hydraulic Grab	7
5.1.1.1 General Technical Description	7
5.1.1.2 General Technical Specifications	8
5.1.1.2.1 General Characteristics	8
5.1.1.2.2 Classification S/FEM.....	8
5.1.1.2.3 Main Lifting Movement	8
5.1.1.2.4 Direction Movement.....	8
5.1.1.2.5 Displacement Movement with Variator	8
5.1.1.2.6 Voltage.....	8
5.1.1.2.7 Hydraulic Grab	8
5.1.1.2.8 Paint.....	9
5.1.1.2.9 Guarantee	Error! Bookmark not defined.
5.1.2 Bag Opener	9
5.1.2.1 General Technical Description	9
5.1.2.2 General Technical Specifications	9
5.1.2.2.1 Installed Items	9
5.1.2.2.2 Capacity	9
5.1.2.2.3 Loading Hopper - Feeder	9
5.1.2.2.4 Drive System	10
5.1.2.2.5 Crushing System	10
5.1.2.2.6 Safety and Cleaning Systems	10
5.1.2.2.7 Switchboard & Controls.....	10
5.1.2.2.8 Paint.....	10
5.1.2.2.9 Guarantee	Error! Bookmark not defined.
5.1.3 Trommel Screen	11
5.1.3.1 General Technical Description	11
5.1.3.2 General Technical Specifications	11
5.1.3.2.1 Installed Items	11
5.1.3.2.2 Capacity	11
5.1.3.2.3 Structure of The Drum	11
5.1.3.2.4 Frame.....	11
5.1.3.2.5 Drum Support	11
5.1.3.2.6 Drum	12
5.1.3.2.7 Safety and Cleaning Systems	12
5.1.3.2.8 Hoppers	12

Section 5A - Schedule of Requirements and Technical Specifications

Subsection 5: Technical Specifications of Treatment Facility

5.1.3.2.9	Drive	12
5.1.3.2.10	Switchboard And Controls	12
5.1.3.2.11	Paint	12
5.1.3.2.12	Guarantee	Error! Bookmark not defined.
5.1.4	<i>Electromagnet</i>	13
5.1.4.1	General Technical Description	13
5.1.4.2	General Technical Specifications	13
5.1.4.2.1	Installed Items	13
5.1.4.2.2	Capacity	13
5.1.4.2.3	Separation Distance	13
5.1.4.2.4	Construction	13
5.1.4.2.5	Drive	13
5.1.4.2.6	Discharge Hoppers	13
5.1.4.2.7	Metal Frame	14
5.1.4.2.8	Rubber Belt	14
5.1.4.2.9	Electrical Panel	14
5.1.4.2.10	Paint	14
5.1.4.2.11	Guarantee	Error! Bookmark not defined.
5.1.5	<i>Eddy Current Separator</i>	14
5.1.5.1	General Technical Description	14
5.1.5.2	General Technical Specifications	15
5.1.5.2.1	Installed Items	15
5.1.5.2.2	Capacity	15
5.1.5.2.3	Vibrating Feeder	15
5.1.5.2.4	Support Frame	15
5.1.5.2.5	Electrical Panel	15
5.1.5.2.6	Discharge Hoppers	15
5.1.5.2.7	Paint	15
5.1.5.2.8	Guarantee	Error! Bookmark not defined.
5.1.6	<i>Ballistic Separator</i>	16
5.1.6.1	General Technical Description	16
5.1.6.2	General Technical Specifications	16
5.1.6.2.1	Installed Items	16
5.1.6.2.2	Capacity	17
5.1.6.2.3	Dimensions	17
5.1.6.2.4	Sheets with Screening Plates	17
5.1.6.2.5	Crankshafts	17
5.1.6.2.6	Motor and Transmission	17
5.1.6.2.7	Metallic Hoppers	17
5.1.6.2.8	Upper Cover	18
5.1.6.2.9	Safety and Cleaning Systems	18
5.1.6.2.10	Support Structure	18
5.1.6.2.11	Paint	18
5.1.6.2.12	Guarantee	Error! Bookmark not defined.
5.1.7	<i>Baler for Recyclables (Paper – Plastics)</i>	18
5.1.7.1	General Technical Description	18
5.1.7.2	General Technical Specifications	19
5.1.7.2.1	Installed Items	19
5.1.7.2.2	Capacity	19
5.1.7.2.3	Dimensions	19
5.1.7.2.4	Automatic Vertical Tying System	19

Section 5A - Schedule of Requirements and Technical Specifications

Subsection 5: Technical Specifications of Treatment Facility

5.1.7.2.5	Main Technical Characteristics	20
5.1.7.2.6	Paint.....	20
5.1.7.2.7	Guarantee.....	Error! Bookmark not defined.
5.1.8	<i>Baler for Metals (Ferrous & Non Ferrous)</i>.....	20
5.1.8.1	General Technical Description	20
5.1.8.2	General Technical Specifications	21
5.1.8.2.1	Installed Items	21
5.1.8.2.2	Capacity	21
5.1.8.2.3	Dimensions	21
5.1.8.2.4	Main Technical Characteristics	21
5.1.8.2.5	Paint.....	21
5.1.8.2.6	Guarantee.....	Error! Bookmark not defined.
5.1.9	<i>Material Transferring Conveyors</i>	22
5.1.9.1	General	22
5.1.9.2	Plate Conveyors (PB Type Conveyor)	22
5.1.9.2.1	Installed Items	22
5.1.9.2.2	Capacity	22
5.1.9.2.3	General Technical Description	22
5.1.9.2.4	General Technical Specifications	22
5.1.9.2.4.1	Carrying Structure.....	22
5.1.9.2.4.2	Quality Of The Sheets	22
5.1.9.2.4.3	Drive	22
5.1.9.2.4.4	Head / Drive Pulley.....	22
5.1.9.2.4.5	Tail Pulley	23
5.1.9.2.4.6	Tightening	23
5.1.9.2.4.7	Displacement.....	23
5.1.9.2.4.8	Central Lubrication	23
5.1.9.2.4.9	Conveyor Metallic Supports.....	23
5.1.9.2.4.10	Feed / Discharge Hopper.....	23
5.1.9.2.4.11	Paint	23
5.1.9.2.4.12	Guarantee	Error! Bookmark not defined.
5.1.9.3	Chain Conveyor.....	24
5.1.9.3.1	Installed Items	24
5.1.9.3.2	Capacity	24
5.1.9.3.3	General Technical Description	24
5.1.9.3.4	General Technical Specifications	24
5.1.9.3.4.1	Carrying Structure.....	24
5.1.9.3.4.2	Carriage.....	24
5.1.9.3.4.3	Drive	24
5.1.9.3.4.4	Head / Drive Pulley.....	24
5.1.9.3.4.5	Tail Pulley	25
5.1.9.3.4.6	Tightening	25
5.1.9.3.4.7	Displacement.....	25
5.1.9.3.4.8	Central Lubrication	25
5.1.9.3.4.9	Conveyor Metallic Supports.....	25
5.1.9.3.4.10	Feed / Discharge Hopper.....	25
5.1.9.3.4.11	Paint	25
5.1.9.3.4.12	Guarantee	Error! Bookmark not defined.
5.1.9.4	Frame Sliding Belt Conveyor	26
5.1.9.4.1	Installed Items	26
5.1.9.4.2	Capacity	26

Section 5A - Schedule of Requirements and Technical Specifications

Subsection 5: Technical Specifications of Treatment Facility

5.1.9.4.3	General Technical Description	26
5.1.9.4.4	General Technical Specifications	26
5.1.9.4.4.1	Carrying Structure.....	26
5.1.9.4.4.2	Conveyor Belt	26
5.1.9.4.4.3	Drive	26
5.1.9.4.4.4	Head / Drive Pulley.....	26
5.1.9.4.4.5	Tail Pulley	26
5.1.9.4.4.6	Tightening	27
5.1.9.4.4.7	Upper Displacement Deck	27
5.1.9.4.4.8	Return Roller Stations	27
5.1.9.4.4.9	Guiding Channels.....	27
5.1.9.4.4.10	Cleaning Scrapers.....	27
5.1.9.4.4.11	Conveyor Metallic Supports.....	27
5.1.9.4.4.12	Protections.....	27
5.1.9.4.4.13	Conveyors With Steep Slope.....	28
5.1.9.4.4.14	Paint	28
5.1.9.4.4.15	Guarantee	Error! Bookmark not defined.
5.1.9.5	Trough Type Belt Conveyor	28
5.1.9.5.1	Installed Items	28
5.1.9.5.2	Capacity	28
5.1.9.5.3	General Technical Description	28
5.1.9.5.4	General Technical Specifications	28
5.1.9.5.4.1	Carrying Structure.....	28
5.1.9.5.4.2	Conveyor Belt	29
5.1.9.5.4.3	Drive	29
5.1.9.5.4.4	Head / Drive Pulley.....	29
5.1.9.5.4.5	Tail Pulley	29
5.1.9.5.4.6	Tightening	29
5.1.9.5.4.7	Upper Roller Stations	29
5.1.9.5.4.8	Return Roller Stations	29
5.1.9.5.4.9	Guiding Channels.....	29
5.1.9.5.4.10	Cleaning Scrapers.....	30
5.1.9.5.4.11	Conveyor Metallic Supports.....	30
5.1.9.5.4.12	Discharge Hopper.....	30
5.1.9.5.4.13	Protections.....	30
5.1.9.5.4.14	Conveyors With Steep Slope.....	30
5.1.9.5.4.15	Paint	30
5.1.9.5.4.16	Guarantee	Error! Bookmark not defined.
5.1.9.6	High Speed Belt Conveyors	31
5.1.9.6.1	Installed Items	31
5.1.9.6.2	Capacity	31
5.1.9.6.3	General Technical Description	31
5.1.9.6.4	General Technical Specifications	31
5.1.9.6.4.1	Carrying Structure.....	31
5.1.9.6.4.2	Conveyor Belt	31
5.1.9.6.4.3	Drive	31
5.1.9.6.4.4	Head / Drive Pulley.....	31
5.1.9.6.4.5	Tail Pulley	31
5.1.9.6.4.6	Tightening	32
5.1.9.6.4.7	Upper Displacement Deck	32
5.1.9.6.4.8	Return Roller Stations	32
5.1.9.6.4.9	Guiding Channels.....	32

Section 5A - Schedule of Requirements and Technical Specifications

Subsection 5: Technical Specifications of Treatment Facility

5.1.9.6.4.10	Cleaning Scrapers.....	32
5.1.9.6.4.11	Conveyor Supports.....	32
5.1.9.6.4.12	Conveyor Cabin-Box.....	Error! Bookmark not defined.
5.1.9.6.4.13	Discharge Hopper.....	33
5.1.9.6.4.14	Protections.....	33
5.1.9.6.4.15	Paint	33
5.1.9.6.4.16	Guarantee	Error! Bookmark not defined.
5.1.9.7	Two Way (Revolving) Belt Conveyor	33
5.1.9.7.1	Installed Items	33
5.1.9.7.2	Capacity	33
5.1.9.7.3	General Technical Description	33
5.1.9.7.4	General Technical Specifications	33
5.1.9.7.4.1	Carrying Structure.....	33
5.1.9.7.4.2	Conveyor Belt	33
5.1.9.7.4.3	Drive	34
5.1.9.7.4.4	Head / Drive Pulley	34
5.1.9.7.4.5	Tail Pulley	34
5.1.9.7.4.6	Tightening	34
5.1.9.7.4.7	Upper Roller Stations	34
5.1.9.7.4.8	Return Roller Stations	34
5.1.9.7.4.9	Guiding Channels.....	34
5.1.9.7.4.10	Cleaning Scrapers.....	34
5.1.9.7.4.11	Conveyor Metallic Supports.....	35
5.1.9.7.4.12	Discharge Hopper.....	35
5.1.9.7.4.13	Protections.....	35
5.1.9.7.4.14	Conveyors with Steep Slope.....	35
5.1.9.7.4.15	Paint	35
5.1.9.7.4.16	Guarantee	Error! Bookmark not defined.
5.1.10	<i>Optical Sorters (NIR)</i>	36
5.1.10.1	General Technical Description	36
5.1.10.2	General Technical Specifications	37
5.1.10.2.1	Installed Items.....	37
5.1.10.2.2	Capacity.....	37
5.1.10.2.3	Technology.....	37
5.1.10.2.4	Detection	37
5.1.10.2.5	Materials Sorting NIR System.....	37
5.1.10.2.6	Ejection	37
5.1.10.2.7	High Resolution Detection	38
5.1.10.2.8	Support Structure.....	38
5.1.10.2.9	Paint.....	38
5.1.10.2.10	Guarantee	Error! Bookmark not defined.
5.1.11	<i>Air Supply System – Air Compressors</i>	38
5.1.11.1	General Technical Description	38
5.1.11.2	General Technical Specifications	39
5.1.11.2.1	Screw Type Air Compressor:	39
5.1.11.2.2	Integrated Refrigeration Type Air Dryer	39
5.1.11.2.3	Pre Filter.....	Error! Bookmark not defined.
5.1.11.2.4	Control Panel	40
5.1.11.2.5	Guarantee	Error! Bookmark not defined.
5.1.12	<i>Sorted 2D Material Shredder</i>	40
5.1.12.1	General Technical Description	40

5.1.12.2	General Technical Specifications	41
5.1.12.2.1	Installed Items.....	41
5.1.12.2.2	Capacity.....	41
5.1.12.2.3	Loading Hopper - Feeder.....	41
5.1.12.2.4	Drive System	41
5.1.12.2.5	Shredding System.....	41
5.1.12.2.6	Safety and Cleaning Systems.....	42
5.1.12.2.7	Switchboard and Controls.....	42
5.1.12.2.8	Paint	42
5.1.12.2.9	Guarantee	Error! Bookmark not defined.
5.2	ANAEROBIC DIGESTION FACILITY TECHNICAL SPECIFICATIONS.....	46
5.2.1	<i>Introduction</i>	46
5.2.2	<i>Technology</i>	46
5.2.3	<i>Biogas Management</i>	47
5.2.4	<i>Fermented Materials Storage</i>	50

5 Technical specifications of Treatment Facility

Process design of the MBT Facility shall be designed according to EN or other international standards. The contractor should use related design standard values. If the Contractor intends to use a patented process that is also complied with this Employer's Requirements, he shall provide all relevant information about this system with his tender.

All the machinery and equipment shall have two years manufacturer warrantee for its good operation, condition and trouble-free performance for the whole machine (mechanical & electrical parts and equipment, metallic parts, paint), starting from the date for issuance of certificate for substantial competition.

5.1 MSW Mechanical Pre-treatment Facility Technical Specifications

In the next paragraphs the technical specifications of **the main mechanical pretreatment facility equipment** are presented. These specifications set the **basic standards** and illustrate the accepted quality of the proposed equipment.

Each tenderer must take into consideration that the installed equipment for the sorting facility must be in accordance with all the design rules - standards and meets the appropriate requirements.

The mechanical equipment must be capable to handle the incoming capacity of each stream and must have been designed and constructed for heavy duty usage and for operation in waste management facilities.

Every tenderer has the ability to design its technical proposal that will incorporate a number of equipment that may differ from the described one. In any case there is no need to use the total described equipment.

5.1.1 Crane Bridge – Hydraulic Grab

5.1.1.1 General Technical Description

The travelling overhead crane bridge will be supplied with a seat and a command desk, which will be installed in the command cabin – control room with all the needed equipment.

The travelling crane will be operated manually or automatically by means of an automation that incorporates absolute positioning encoders.

A Weighing system with a visual display unit will be also installed.

A motorized spring box for the grabber feeding will be supplied.

Trays, cabling grids, electrical panels next to the travelling crane and climate control unit next to the box.

Cable anti-overriding system and loose cable detector.

Motors will be supplied with thermal probes and limit switches for all movements.

It will also be supplied with a horn, a camera for the pit, anti-collision system by means of infrared elements with double cell. General disconnecting switch in the MCC with emergency stops in each command position.

The overhead crane bridge shall be brand new, unused.

5.1.1.2 General Technical Specifications

5.1.1.2.1 General Characteristics

N	No of items	1 in above MSW reception area
N	Travelling Crane type	Double rail box
N	Hoist type	open carriage
N	Lifting capacity	Min. 9.000 Kg and according to contractor's design & calculations
N	Space between rails axles	According to contractor's design

5.1.1.2.2 Classification S/FEM

N	Structure	A7
N	Mechanisms	M8

5.1.1.2.3 Main Lifting Movement

N	Main speed	0 - 16 m/min \pm 5%
N	Motor power	According to contractor's design and selected equipment
N	Protection	IP 55
N	Control with inverter	Yes

5.1.1.2.4 Direction Movement

N	Main speed	0-20 m/min \pm 10%
N	Motor power	According to contractor's design and selected equipment – IE3
N	Protection	IP 55
N	Control with inverter	Yes

5.1.1.2.5 Displacement Movement with Variator

N	Main speed	0 - 60 m/min \pm 10%
N	Motor power	According to contractor's design and selected equipment – IE3
N	Protection	IP 55
N	Control with inverter	Yes

5.1.1.2.6 Voltage

N	Feeding voltage	400 V - 50 Hz
N	Command voltage	220 V

5.1.1.2.7 Hydraulic Grab

N	Capacity	> 6 m3 and according to contractor's design & calculations
N	No of Arms	6
N	Motor power	according to contractor's design and selected equipment– IE3
N	Unit weight	according to contractor's design and selected equipment
N	Material	Special steel – 450 HB

5.1.1.2.8 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N	Primer:	2 layers of a 2 component polyurethane primer
N	Layer thickness:	40 µm of dry layer thickness for each layer
N	Top coat:	2 layers of a 2 component polyurethane primer
N	Layer thickness:	40 µm of dry layer thickness for each layer
N	Total layer thickness:	min. 160 µm dry layer thickness

5.1.2 Bag Opener

5.1.2.1 General Technical Description

The bag opener must be suitable to open the bags that contain the incoming MSW and achieve the reduction of the size of the voluminous waste.

The equipment will have a rotor that turns at a low speed and it is driven by means of an electric motor. The transmission system consists of a hydraulic pump and a clutch (planetary type). The rotor incorporates a series of tearing teeth, located in a spiral form along its complete surface, which open the bags by tearing them against some fixed teeth. The distance between the teeth of the rotor and the static teeth will be adjustable by means of a hydraulic system.

This must be an equipment of maximum effectiveness with regard to the task of opening bags which, avoiding to being very aggressive with the material contained in them, increases the effectiveness of any selection or recovery process of materials.

The bag opener shall be brand new, unused.

5.1.2.2 General Technical Specifications

5.1.2.2.1 Installed Items

At least one bag opener will be installed for each process line.

5.1.2.2.2 Capacity

The bag opener must have a minimum capacity according to constructor's technical proposal and mass balance. In any case the capacity will be > 25 tph.

5.1.2.2.3 Loading Hopper - Feeder

- N Constructed from metal sheets of > 4mm thickness and the appropriate reinforcement
- N Dimensions according to contractor's design & calculations

- N Effective volume of the hopper minimum 15m³
- N Feeder which consists of a metallic moving floor

5.1.2.2.4 Drive System

- N Type: Asynchronous motor – min. IE3
- N Speed: approx. 1480 rpm
- N Voltage: 400-690 V
- N Frequency: 50 Hz
- N Motor protection: PTC
- N Type of protection: IP 55

The drive system is composed of (indicatively):

- N 2 Hydraulic pumps.
- N 1 Hydraulic motor.
- N 1 Planetary reduction gear.
- N 1 Crushing drum with tools that are highly resistant to wear.

Other drive system can be used, according to the manufacturer.

5.1.2.2.5 Crushing System

The crushing system has the following main characteristics (indicatively):

- N Hydraulic drive with automatic power regulation
- N Drum speed adjustable in a progressive way, without steps
- N The reverse cycles of the drum can be preselected
- N Rotor speed approx. 20-40 rpm

Other crushing system can be used, according to the manufacturer.

5.1.2.2.6 Safety and Cleaning Systems

In order to be able to clean the rotor of the equipment in a safe and ergonomic way, there is a lateral gate which is opened by means of a hydraulic pump and allows access in the inner part of the equipment with maximum reliability and comfort.

In order to avoid the gate opening during the operation of the equipment, there are some pins which prevent the counter comb from opening and support it when it is open.

5.1.2.2.7 Switchboard & Controls

These are made up of a main switchboard which is lockable externally, inverter, and motor protection in case of temperature increase (PTC) and high voltages.

- N PLC with 7" touch screen
- N Emergency stop button
- N Protection: IP 55
- N Signal exchange via potential-free contacts

5.1.2.2.8 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N Primer:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Top coat:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Total layer thickness:	min. 160 µm dry layer thickness

5.1.3 Trommel Screen

5.1.3.1 General Technical Description

The trommel screen is a rotary screen in which the incoming material is separated according to its size. It consists of a cylindrical drum with perforated plates. The material is moving forward thanks to a light slope (approx. 2-4) of the drum and by means of its rotation.

The Trommel Screen shall be integrated in the municipal solid waste sorting line with a minimum carrying capacity of 25 tons per hour at a maximum rotational speed of 21 rpm (8-21 by means of inverter).

The Trommel Screen shall consist of a drum with 70 & 250 mm openings - holes (or other openings dimensions according to tenderer's proposal) throughout the cylindrical body of the Trommel.

The upper cover of the trommel screen must be designed in such a way so as to:

- N guarantee the safety of the workers,
- N The accessibility
- N The easy cleaning and maintenance of its mechanical components.

The Trommel Screen shall be brand new, unused.

5.1.3.2 General Technical Specifications

5.1.3.2.1 Installed Items

At least one drum screen will be installed for each process line.

5.1.3.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.3.2.3 Structure of The Drum

The structure of the drum consists of longitudinal and transverse IPE metallic profiles or others, which form the chassis on which the other parts of the drum are located.

5.1.3.2.4 Frame

The Mounting and support frame and maintenance platform shall be included with the Trommel Screen made of at least 3-4 mm thick steel plates and at least 10 mm thick steel I beams for columns, beams and bracing.

5.1.3.2.5 Drum Support

On the basis of the structure of the sieve drum four sets of two wheels are installed in a divided way and covered with vulcanized rubber. These wheels are fastened on two bearing supports

and connected to the shaft with self-blocking couplings of 100 x 145 x 33 or similar.

5.1.3.2.6 Drum

The drum is made up of two rolling tracks where the wheels are supported and work (the motive ones as well as the tensile ones). To these tracks 6 profiles (T, angular or welded U) are joined and make up a robust and resistant structure, to which the screening plates are screwed until they cover the whole length. The inner side of the drum can be equipped with bag-opening teeth in case the process requires it. The drum shall be made of wear-resistant anti-abrasive steel 8-10 mm thick rolled steel capable of withholding abrasive materials continuously.

5.1.3.2.7 Safety and Cleaning Systems

The trommel screen has an access door to the inside of the drum. This door forms an entrance walkway for a better access when it is opened. All the models have maintenance walkways and access stairs with banisters around the equipment.

In order to facilitate the cleaning works of the drum, the sieve drum chassis is equipped with inspection windows along one side of the drum. All the windows have a safety system in order to prevent their opening when the equipment is in operation.

5.1.3.2.8 Hoppers

The inlet, outlet and screened fractions hoppers shall be designed with a solid frame construction of profile steel. The hoppers walls shall be made at least of 4 mm steel sheets and metallic profiles for its reinforcement.

5.1.3.2.9 Drive

Rotation speed between 8 and 21 rpm with frequency converter (nominal 12 rpm). The screen drum shall be powered by two geared AC motors electrically driven motors 50 HZ, 3 phase. The motor type and frequency converter shall be of very good quality with endurance guaranteed (experienced in other similar projects or facilities).

5.1.3.2.10 Switchboard and Controls

These are made up of a main switchboard which is lockable externally, inverter, and motor protection in case of temperature increase (PTC) and high voltages.

- N PLC with 7'' touch screen
- N Emergency stop button
- N Protection: IP 55
- N Signal exchange via potential-free contacts

5.1.3.2.11 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- | | |
|--------------------------|---|
| N Primer: | 2 layers of a 2 component polyurethane primer |
| N Layer thickness: | 40 µm of dry layer thickness for each layer |
| N Top coat: | 2 layers of a 2 component polyurethane primer |
| N Layer thickness: | 40 µm of dry layer thickness for each layer |
| N Total layer thickness: | min. 160 µm dry layer thickness |

5.1.4 Electromagnet

5.1.4.1 General Technical Description

Self-cleaning electromagnetic overband separators are designed for extraction and retrieval of ferrous magnetic materials from conveyed material.

The overband separator is made of a powerful electromagnet, which supports the small ribbed belt covering the electromagnet.

Small frames interlocked to the electromagnet support the drive drum, redelivery drums, and gear motor driving the band.

Self-cleaning electromagnetic overband separators are used for automatic extraction of materials, ensuring high recovery of ferrous materials.

As the ferrous magnetic materials on the conveyor belt come within the electromagnet's magnetic field, the ferrous material is attracted and pulled up to belt around the magnet. Ribs clear ferrous materials of the electromagnet's magnetic field and discharge them freely.

Separators are installed across the conveyor belt.

Choice of the ideal separator and of the most appropriate erection depends on several factors:

- N Product type
- N Materials flow and flow rate
- N Grain size
- N Dimension of magnetic material
- N Belt width
- N Belt speed

The electromagnets shall be brand new, unused.

5.1.4.2 General Technical Specifications

5.1.4.2.1 Installed Items

According to the design and technical proposal. At least 2 electromagnets will be installed.

5.1.4.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.4.2.3 Separation Distance

In order to be able to sort the material with the maximum efficiency, the magnetic separator will be positioned at a distance of 350 – 450 mm above the conveyor under the magnet. This distance ensures that the material flows freely and at the same time the performance of the magnetic separator is the highest.

5.1.4.2.4 Construction

It is composed of two cylinders; one is a motor cylinder and the other is a guided one; and by a rubber belt with towing transverse profiles.

5.1.4.2.5 Drive

A KA-type conic group, with hollow shaft, directly fixed on the foot and supported by a reaction arm with two shock absorbing plugs so as to avoid any vibrations of the group.

5.1.4.2.6 Discharge Hoppers

Both the part of the belt where the magnetic separator is positioned, and the ferrous material discharge hopper are made of stainless steel so as to avoid that the material gets stuck on them.

5.1.4.2.7 Metal Frame

The magnetic separator frame is used so as to install the equipment in a versatile way and with easy access to any part of the installation. In order to adjust the distance between the magnetic separator and the belt, this latter is subjected to the frame by means of chains that allow its positioning.

5.1.4.2.8 Rubber Belt

High strength EP400 / 3 rubber belt will be used for the selected electromagnets.

5.1.4.2.9 Electrical Panel

The equipment will incorporate its own electrical panel. It is also equipped with a drive by means of a key selector with two positions:

N Local: operation with only this unit running

N Remote: the equipment starts in sequence with the rest of the equipment

5.1.4.2.10 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N Primer:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Top coat:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Total layer thickness:	min. 160 µm dry layer thickness

5.1.5 Eddy Current Separator

5.1.5.1 General Technical Description

The Eddy Current Separator (ECS) is an advanced metal sorting system/ unit that is capable of separating non-ferrous metals such as aluminum and copper from dry recyclables.

An Eddy Current Separator consists of a short belt conveyor that has its drive located at the return end and a high-speed magnetic rotor system installed at the discharge end. The magnetic rotor, which is positioned within a separately rotating non-metallic drum, revolves at around 3000 revolutions per minute during operation whilst the outer drum cover rotates at the speed of the Eddy Currents' belt conveyor.

As the rotor spins at these high speeds, an electric current is induced into conducting metals. The induced electric current produces a magnetic field, which opposes the field created by the rotor, repelling the conducting metals over a pre-positioned splitter plate. The remaining materials such as plastics, glass and other dry recyclables will simply free-fall over the rotor, separating them from the repelled metals.

In this way, three different products are obtained:

- Non-ferrous metals.
- Ferrous metals.
- Rest of material.

The non-ferrous metal separator must be fed by means of a vibrating feeder that spreads the material on the conveyor belt.

It is adjustable to the most varied materials and grain-sizes, easily efficient for those from 6 to 300mm, taking into account that each grain-size has its particular sorting conditions, speed, etc. In order to obtain the most appropriate performance, it is recommendable to presort the material.

The eddy current separator shall be brand new, unused.

5.1.5.2 General Technical Specifications

5.1.5.2.1 Installed Items

According to the design and technical proposal. At least 1 eddy current separator will be installed.

5.1.5.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.5.2.3 Vibrating Feeder

The vibrating feeder is basically used to dose the material in a fix flow. The vibrating feeder is supported by the frame of the eddy current separator.

5.1.5.2.4 Support Frame

The Eddy current separator and the vibrating feeder are supported by a frame that can vary according to the project.

5.1.5.2.5 Electrical Panel

The unit is composed of its own electrical panel, where both the eddy current separator and the vibrating table are integrated.

From the electrical panel the following parameters can be modified by means of potentiometers:

- N Speed of the Eddy current separator belt.
- N Vibration of the feeder to adjust the capacity.
- N Speed of the magnetic rotor.

It is also equipped with a drive by means of a key selector with two positions:

- N Local: operation with only this unit running
- N Remote: the equipment starts in sequence with the rest of the installation

5.1.5.2.6 Discharge Hoppers

These will be designed according to the place of the conveyors that collect the different fractions that are sorted by the eddy current separator. The hoppers shall be designed with a solid frame construction of profile steel. The hoppers walls shall be made of 4 mm steel sheets and metallic profiles for its reinforcement.

5.1.5.2.7 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- N Primer: 2 layers of a 2 component polyurethane primer

- | | | |
|---|------------------------|--|
| N | Layer thickness: | 40 μm of dry layer thickness for each layer |
| N | Top coat: | 2 layers of a 2 component polyurethane primer |
| N | Layer thickness: | 40 μm of dry layer thickness for each layer |
| N | Total layer thickness: | min. 160 μm dry layer thickness |

5.1.6 Ballistic Separator

5.1.6.1 General Technical Description

The ballistic separator performs an effective separation of waste according to different physical characteristics. This separation, known as gravimetric, is one of the main tasks before sending the waste to the manual/automatic sorting phase. The ballistic separator classifies the flow of material into three fractions: heavy and rolling fraction (called 3D), flat and light fraction (called 2D) and the sieved fraction (or under screen fine fraction).

The types of waste that can be screened with the ballistic separator are numerous: lightweight packaging, paper/cardboard, foil and plastic containers, commercial and industrial waste (C&I), municipal solid waste (MSW), waste from construction and demolition (C&D).

Hence, the output flows of a ballistic separator are:

- N Heavy and rolling fraction, 3D: flacons and plastic bottles (PET and polyethylene HD), cans, wood, stones...
- N Flat and light fraction, 2D: envelopes, trays and plastic film (polyethylene LD), textiles, paper and cardboard...
- N Sieved fraction: depending on the size of the holes of the grids on the screening paddles it possible to classify different sizes of under screen fraction. This fraction, typically not recoverable, has dimensions approximately of 40-50 mm and it contains soil, sand, organic waste and small pieces of recyclables.

The degree of the inclination of the equipment is adjusted by a hydraulic station which drives two lateral cylinders, and in the lower part three fans are incorporated which help to improve the efficiency of separating flat and rolling parts. The speed of the oscillatory movement of the paddles can also be regulated so that the equipment has manifold adjustable parameters to adapt itself to the type of waste to be processed.

The equipment will also incorporate an upper soundproof cover, cleaning access, maintenance access to the crankshafts and centralized lubrication system.

The ballistic separator shall be brand new, unused.

5.1.6.2 General Technical Specifications

5.1.6.2.1 Installed Items

According to the design and technical proposal. At least 1 ballistic separator will be installed.

5.1.6.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.6.2.3 Dimensions

Length:	According to manufacturer
Width:	According to manufacturer
Height:	According to manufacturer
Weight of the equipment:	According to manufacturer
Slope:	From 9° to 18°, with hydraulic cylinders

5.1.6.2.4 Sheets with Screening Plates

Sheet quantity:	According to manufacturer
Sheet width:	According to manufacturer
Sheet length:	According to manufacturer
Screening holes:	Depends on the process
Weight of individual sheet:	220 kg approx.
Sheet material – thickness:	ST 37, 3 mm thick

5.1.6.2.5 Crankshafts

Crankshaft quantity:	2 units
Crankshaft speed:	200 rpm approx. (indicatively)

5.1.6.2.6 Motor and Transmission

Type:	Geared motor
Motor brake:	Brake in the motor of the motive shaft
Power:	According to manufacturer
Drive type:	According to manufacturer
Hydraulic group:	According to manufacturer
Fan:	According to manufacturer
Motor location:	According to manufacturer
Type of coupling:	Rubber
Type of drive mechanism:	Direct transmission by means of coupling plate or other

5.1.6.2.7 Metallic Hoppers

The ballistic separator will be equipped with three hoppers (one for each separated fraction) in order to lead the discharged material on the belt and prevent material from falling on the pavement. The hoppers are manufactured with steel sheet of 3 mm thickness, fixed to the structure of the ballistic separator and once the belts for the collection of the exit materials have been installed, the hoppers are adjusted to them to guarantee the safety and cleaning of the process.

The measures of the exit hoppers are the following:

Hopper 3D, rolling parts:	According to design & manufacturer
---------------------------	------------------------------------

Hopper fine fraction: According to design & manufacturer

Hopper 2D, flat parts: According to design & manufacturer

5.1.6.2.8 Upper Cover

The ballistic separator will be covered with an upper cover of sandwich-type panels that reduce the noise which can be caused by the material that is treated in the ballistic separator and prevents objects from being thrown outside of the machine.

5.1.6.2.9 Safety and Cleaning Systems

The ballistic separator has an access door to enter its inner part. When it is opened, one has access to the upper part of the paddles so that the cleaning of the screening holes is easier. This door has a safety system in order to prevent its opening when the equipment is in operation.

In order to facilitate the cleaning and maintenance works of the crankshafts and of the part below the paddles, the ballistic separator has a collapsible sliding walkway which allows having access to the maintenance areas.

5.1.6.2.10 Support Structure

The support structure is built with laminated steel profiles type HEA or similar, screwed between themselves and united by struts, forming a rigid construction without bending.

It has maintenance walkways and access stairs with banisters around the equipment.

5.1.6.2.11 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N Primer:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Top coat:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Total layer thickness:	min. 160 µm dry layer thickness

5.1.7 Baler for Recyclables (Paper – Plastics)

5.1.7.1 General Technical Description

The recyclables are transferred into the baler's metallic hopper by means of a chain conveyor. Once the hopper is full of material, the baler's main piston runs forward and the material is entering the tunnel, thanks to the metallic plate's pressure. The working pressure has been previously set at the desired value. Once the desired bale length is obtained, it is tied automatically with steel wire.

The unit is basically composed of:

1. An open tunnel with adjustable (at the exit) hydraulic pins and a double effect hydraulic piston which triggers the baling carriage, equipped with blades to cut the remaining material when this enters the tunnel.
2. Reception hopper for material from the chain conveyor belt, equipped with loading control sensor.
3. Hydraulic station with double body pump, auxiliary pump, safety valves and distribution valves.
4. Complete electrical board: for operation, optical control and push-button box for manual and automatic drive. Electrical control by means of touching screen.
5. Four tying points at the upper area.
6. Bale length measuring system.

The baler for the recyclables (paper / plastics) compaction shall be brand new, unused.

5.1.7.2 General Technical Specifications

5.1.7.2.1 Installed Items

According to the design and technical proposal. At least 1 baler for paper / plastics will be installed.

5.1.7.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.7.2.3 Dimensions

Length:	According to manufacturer
Width:	According to manufacturer
Height:	According to manufacturer
Weight of the equipment:	According to manufacturer

5.1.7.2.4 Automatic Vertical Tying System

The automatic tying system is composed of:

- N A set of needles, which is driven by a motor-reducer, to collect the wire of the lower part of the baler.
- N A set for the cutting and bending of the wires:
 - a. A blade driven by a hydraulic cylinder, which cuts the wires in a series of steps.
 - b. Picklocks placed outside the set and that turn by means of an electrically driven motor-reducer so as to plait the wires.

The baler has the necessary routes and recirculations to guide the wire to the tying set.

Type of tying system:	vertical
Tying material:	wire

Wire cut:	guillotine system
Wire guiding bars:	chroming, with thermally treated wheels and needles

5.1.7.2.5 Main Technical Characteristics

The main technical characteristics are presented below:

Compaction force:	Min 65 Tns.
Specific pressure:	Min 84 N/cm ² .
Channel section (height x width):	Approx. 75 x 100 cm.
Feeding opening (length x width):	Approx. 140 x 92 cm.
Number of ties:	Min 4
Installed power:	According to manufacturer
Pump capacity:	Min 350 l/min.
Volume of hydraulic oil deposit:	According to manufacturer
Cylinder diameter:	According to manufacturer

5.1.7.2.6 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N Primer:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Top coat:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Total layer thickness:	min. 160 µm dry layer thickness

5.1.8 Baler for Metals (Ferrous & Non-Ferrous)

5.1.8.1 General Technical Description

The recovered metallic materials from will be collected and fed mechanically into a conveyor belt which will transfer them to the feed hopper of the baling press.

The metal balers will be of horizontal type with a knife. It will be designed for metals baling.

The supplied baler for metals will be a compact, robust machine, suitable for metals compaction and baling (beverage cans, wire, etc.). The machine must be capable to reach very high densities of the produced bales.

It will be made of a durable steel frame of compact size to allow its installation in narrow areas.

The hydraulic system and the baler will form a compact unit so to ensure high reliability with less maintenance, making the heating of the hydraulic oil decreases. The silent installation of pumps in the tank gear hydraulic oil also helps to reduce the noise level.

System V cutting knives, will be installed in the chassis of the baler in order to ensure the appropriate cutting when the products are heavy and bulky.

The baler will be provided with a PLC that will provide its safe operation. The movement of the circuit pressure plate will be controlled by sensor's proximity. The automatic sequence of work can be also controlled manually. There will be safeguards to prevent incorrect operations.

The baler for the metals (ferrous & nonferrous) compaction shall be brand new, unused.

5.1.8.2 General Technical Specifications

5.1.8.2.1 Installed Items

According to the design and technical proposal. At least 1 baler for metals will be installed.

5.1.8.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.8.2.3 Dimensions

Length:	According to manufacturer
Width:	According to manufacturer
Height:	According to manufacturer
Weight of the equipment:	According to manufacturer

5.1.8.2.4 Main Technical Characteristics

The main technical characteristics are presented below:

Working pressure:	min 650 kN.
Max. Pressure:	min 260 N/cm ² .
Bale size:	Approx. 50 x 50 cm.
Baling box:	Approx. 100 x 45 cm.
Diameter of the cylinder:	According to manufacturer
Drive:	According to manufacturer
Load capacity (1-3 strokes):	Approx. 15 / 30 m ³ /h.
Capacity of oil tank:	According to manufacturer
Pump Flow:	According to manufacturer

5.1.8.2.5 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N Primer:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer
N Top coat:	2 layers of a 2 component polyurethane primer
N Layer thickness:	40 µm of dry layer thickness for each layer

N Total layer thickness: min. 160 µm dry layer thickness

5.1.9 Material Transferring Conveyors

5.1.9.1 General

In the next paragraphs the main technical characteristics of the different material transferring conveyors are presented. Every tenderer can use any type of transferring conveyor into the process line in order to complete the process line. In any case the selected machine must be designed in accordance to the quantity and technical characteristics of the material in order to work properly.

5.1.9.2 Plate Conveyors ()

5.1.9.2.1 Installed Items

According to the design and technical proposal.

5.1.9.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.9.2.3 General Technical Description

The main feature of the plate conveyors is that the transport deck consists of a number of reinforced metal sheets and not an elastic belt.

The plate conveyors shall be brand new, unused.

5.1.9.2.4 General Technical Specifications

5.1.9.2.4.1 Carrying Structure

The chassis or frame of the conveyor is built with steel sheet and tubular profiles, with welded reinforcement angles forming a rigid structure without flexions. In its front and rear part the design allows the lodging of the drive and tightening mechanisms.

5.1.9.2.4.2 Quality of The Sheets

Reinforced metal plates made up of S 235 JRG2 steel or higher.

5.1.9.2.4.3 Drive

Geared motor with hollow shaft, fixed directly on the shaft of the motive header and supported with a reaction arm which has shock-absorbing plugs so to avoid possible vibrations of the group.

5.1.9.2.4.4 Head / Drive Pulley

It is made up of a mechanized shaft and a sprocket on each end, which are fixed to the shaft by means of a wedging piece. The bearing supports with a tightening device that works by spindle in order to correct the alignments of the motive shaft.

5.1.9.2.4.5 Tail Pulley

It is made up of a mechanized shaft and a sprocket on each end, with a passage of 200 mm, placed and fixed to the shaft by means of a small screw.

5.1.9.2.4.6 Tightening

The tensioning system of the belt is realized by means of two spindles guided by bearing supports on the top of a structure that is reinforced by U profiles.

5.1.9.2.4.7 Displacement

The movement of the conveyor sheets is carried out by means of 2 side chains that are interconnected by the plates with or without hauling profiles.

The chains are of type FV-B 140 with a passage of 200 mm or similar. On the chain a number of L 80x80x8x80 angular profiles are welded, which are also screwed to the metallic sheets.

5.1.9.2.4.8 Central Lubrication

This type of conveyors incorporates a lubrication system located on both sides of the conveyor, which is based on an oil dropping lubrication with brush.

5.1.9.2.4.9 Conveyor Metallic Supports

The support bases of the conveyor are made of appropriate dimensions UPN profiles, which have an adjustable base in order to be able to level them out according to the needs of the pavement.

5.1.9.2.4.10 Feed / Discharge Hopper

The feed or discharge hopper (if needed) is manufactured with laminated sheet of a thickness of 3 mm. The discharge hopper will be designed to pick up the material that is removed by the scraper. If needed the hoppers will be reinforced by angular and/or rectangular metallic profiles.

5.1.9.2.4.11 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- N Primer: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 μm of dry layer thickness for each layer
- N Top coat: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 μm of dry layer thickness for each layer
- N Total layer thickness: min. 160 μm dry layer thickness

5.1.9.3 Chain Conveyor

5.1.9.3.1 Installed Items

According to the design and technical proposal.

5.1.9.3.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.9.3.3 General Technical Description

The main feature of this type of conveyor is that the plates are sliding on the top of the frame and are hauled by side chains fixed to it by means of the appropriate metallic profiles.

The chain conveyors shall be brand new, unused.

5.1.9.3.4 General Technical Specifications

5.1.9.3.4.1 Carrying Structure

The chassis or frame of the conveyor is built with laminated profiles and bent steel sheet, with welded reinforcement angles and transverse connection profiles type UPN or other, screwed and separated every 250 mm, forming a rigid unit of great resistance. In its front and rear part the design allows the lodging of the drive and tightening mechanisms.

5.1.9.3.4.2 Carriage

The carrying pieces are formed of material folded steel plates 4mm thick and are subjected to the drive chains by means of screws. The upper transverse profiles washing material are angular rate of 50, 60 and 80 mm (depending on the inclination of the conveyor), and are located every 750 mm.

5.1.9.3.4.3 Drive

Geared motor with hollow shaft, fixed directly on the shaft of the motive header and supported with a reaction arm which has shock-absorbing plugs so to avoid possible vibrations of the group.

5.1.9.3.4.4 Head / Drive Pulley

It is made up of a mechanized shaft and a sprocket on each end, which are fixed to the shaft by means of a wedging piece. The bearing supports with a tightening device that works by spindle in order to correct the alignments of the motive shaft.

5.1.9.3.4.5 Tail Pulley

It is made up of a mechanized shaft and a sprocket type M112 or similar on each end, with a passage of 125 mm, Z10, placed and fixed to the shaft by means of a small screw.

5.1.9.3.4.6 Tightening

The tensioning system of the belt is carried out by means of bearing supports, guided on a reinforced structure of UPN profiles, with a tightening system by means of a spindle.

5.1.9.3.4.7 Displacement

The movement of the plates are carried out by means of chains held on the same plates. The chains consist of solid bolts M-112 with a diameter of the roller of 60 mm, with a passage of 125 mm.

5.1.9.3.4.8 Central Lubrication

This type of conveyors incorporates a lubrication system that is located on both sides of the conveyor, which is based on an oil dropping lubrication with brush.

5.1.9.3.4.9 Conveyor Metallic Supports

The support bases of the conveyor are made of appropriate dimensions UPN profiles, which have an adjustable base in order to be able to level them out according to the needs of the pavement.

5.1.9.3.4.10 Feed / Discharge Hopper

The feed or discharge hopper (if needed) is manufactured with laminated sheet of a thickness of 3 mm. The discharge hopper will be designed to pick up the material that is removed by the scraper. If needed the hoppers will be reinforced by angular and/or rectangular metallic profiles.

5.1.9.3.4.11 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N Primer: 2 layers of a 2 component polyurethane primer

N	Layer thickness:	40 µm of dry layer thickness for each layer
N	Top coat:	2 layers of a 2 component polyurethane primer
N	Layer thickness:	40 µm of dry layer thickness for each layer
N	Total layer thickness:	min. 160 µm dry layer thickness

5.1.9.4 Frame Sliding Belt Conveyor

5.1.9.4.1 Installed Items

According to the design and technical proposal.

5.1.9.4.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.9.4.3 General Technical Description

The main feature of the frame sliding conveyors is that the belt slides on the frame sheet.

The belt conveyors shall be brand new, unused.

5.1.9.4.4 General Technical Specifications

5.1.9.4.4.1 Carrying Structure

The chassis or frame of the conveyor is built with steel sheet and tubular profiles, with welded reinforcement angles forming a rigid structure without flexions. In its front and rear part the design allows the lodging of the drive and tightening mechanisms.

5.1.9.4.4.2 Conveyor Belt

The conveyor belt is made up of various layers of synthetic fiber fabrics of polyester-nylon, of high resistance with a covering of grease - and oil - resistant material (acrylonitrile) of type EP 400/3, 2:0 mm.

5.1.9.4.4.3 Drive

Geared motor with hollow shaft, fixed directly on the shaft of the cylinder and supported with a reaction arm which has shock-absorbing plugs to avoid possible vibrations of the group.

5.1.9.4.4.4 Head / Drive Pulley

It is made up of an appropriate diameter drum, convex on its ends, covered with rubber engraved in diamond shape of 8 mm in order to avoid slipping and / or the displacement of the belt.

5.1.9.4.4.5 Tail Pulley

It is made up of an appropriate diameter drum, convex on its ends in order to avoid the displacement of the belt.

5.1.9.4.4.6 Tightening

The tensioning system of the belt is realized by means of two spindles guided by bearing supports, on the top of a structure that is reinforced by U profiles.

5.1.9.4.4.7 Upper Displacement Deck

Displacement on sheet.

5.1.9.4.4.8 Return Roller Stations

Built with small plates with lodgings for the shafts of the rollers of heavy series with grease-resistant cleaning rings.

5.1.9.4.4.9 Guiding Channels

The guiding channels are built with steel sheets with a thickness of 3 mm, supported by small plates that are screwed to the chassis of the conveyor. The channels are furnished with rubber parts (lateral skirts) for the adjustment on the belt, they are not so hard, adjustable and interchangeable.

5.1.9.4.4.10 Cleaning Scrapers

This type of conveyors incorporates two scrapers; one scraper for the outer part of the belt, adjustable in height and working angle, which is located at the lower part of the motive cylinder.

The other scraper, with a triangular shape, is installed on the tensile cylinder, made of black rubber of 60 shores on the interior side of the belt, thus avoiding that objects can penetrate between the cylinder and the belt.

For reversible belts two inner scrapers shall be used.

5.1.9.4.4.11 Conveyor Metallic Supports

The support bases of the conveyor are made of appropriate dimensions UPN profiles, which have an adjustable base in order to be able to level them out according to the needs of the pavement.

5.1.9.4.4.12 Protections

In order to avoid accidents, the tensile cylinder will be protected / covered. If the conveyor has a maintenance walkway, an emergency stop with a cable pull shall be installed.

Lower covers of the conveyor up to a height of 2.50 m from the floor.

5.1.9.4.4.13 Conveyors with Steep Slope

If the conveyor has a steep slope ($> 20^\circ$), a belt with trough surface shall be used, lower cylinders of the appropriate diameter without cleaning rings, scraper with brush and motor with brake.

5.1.9.4.4.14 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- N Primer: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 μm of dry layer thickness for each layer
- N Top coat: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 μm of dry layer thickness for each layer
- N Total layer thickness: min. 160 μm dry layer thickness

5.1.9.5 Trough Type Belt Conveyor

5.1.9.5.1 Installed Items

According to the design and technical proposal.

5.1.9.5.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.9.5.3 General Technical Description

The main feature of that type of conveyors is that the belt slides on the upper roller stations in form of a trough.

The trough belt conveyors shall be brand new, unused.

5.1.9.5.4 General Technical Specifications

5.1.9.5.4.1 Carrying Structure

The chassis or frame of the conveyor will be built with metallic profiles type UPN or other, reinforced with tubular struts, forming a rigid unit of great resistance. In its front and rear part, the design allows the lodging of the drive and tightening mechanisms.

5.1.9.5.4.2 Conveyor Belt

The transport belt is made up of various layers of synthetic fiber fabrics of polyester-nylon, of high resistance with a covering of grease - and oil - resistant material (acrylonitrile) of type EP 400/3, 4:2 mm.

5.1.9.5.4.3 Drive

Geared motor with hollow shaft, fixed directly on the shaft of the cylinder and supported with a reaction arm which has shock-absorbing plugs to avoid possible vibrations of the group.

5.1.9.5.4.4 Head / Drive Pulley

It is made up of an appropriate diameter drum, convex on its ends, covered with rubber engraved in diamond shape of 8 mm in order to avoid slipping and / or the displacement of the belt.

5.1.9.5.4.5 Tail Pulley

It is made up of an appropriate diameter drum, convex on its ends in order to avoid the displacement of the belt.

5.1.9.5.4.6 Tightening

The tensioning system of the belt is realized by means of two spindles guided by bearing supports, on top of a structure that is reinforced by U profiles.

5.1.9.5.4.7 Upper Roller Stations

They are built with small plates with lodgings for the shafts of the three carrying rollers. These form a trough at 30° (general rule), for the corresponding belt width, with its respective cylinders of heavy series.

5.1.9.5.4.8 Return Roller Stations

They are built with small plates with lodgings for the shafts of the rollers of heavy series with grease – resistant cleaning rings.

5.1.9.5.4.9 Guiding Channels

The guiding channels are built with steel sheet with a thickness of 3 mm, supported by small plates screwed to the chassis of the conveyor. The channels are furnished with rubber parts (lateral skirts) for the adjustment on the belt, they are not so hard, adjustable and interchangeable.

5.1.9.5.4.10 Cleaning Scrapers

This type of conveyors incorporates two scrapers; one scraper for the outer part of the belt, adjustable in height and working angle, which is in the lower part of the motive cylinder.

The other scraper, with a triangular shape, is installed on the tensile cylinder, made of black rubber of 60 shores on the interior side of the belt, thus avoiding that objects can penetrate between the cylinder and the belt.

For reversible belts two inner scrapers shall be installed.

5.1.9.5.4.11 Conveyor Metallic Supports

The support bases of the conveyor are made of appropriate dimensions UPN profiles, which have an adjustable base in order to be able to level them out according to the needs of the pavement.

5.1.9.5.4.12 Discharge Hopper

The discharge hopper will be manufactured by laminated sheets with a thickness of 3 mm. It will be designed to collect the material that is “cleaned” by the scraper.

5.1.9.5.4.13 Protections

In order to avoid accidents, the tensile cylinder will be protected / covered. If the conveyor has a maintenance walkway, an emergency stop with a cable pull shall be installed.

Lower covers of the conveyor up to a height of 2.50 m from the floor.

5.1.9.5.4.14 Conveyors with Steep Slope

If the conveyor has a steep slope ($> 20^\circ$), a belt with profiles shall be installed, lower cylinders without cleaning rings, scraper with brush and motor with brake.

5.1.9.5.4.15 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- N Primer: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 μm of dry layer thickness for each layer
- N Top coat: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 μm of dry layer thickness for each layer
- N Total layer thickness: min. 160 μm dry layer thickness

5.1.9.6 High Speed Belt Conveyors

5.1.9.6.1 Installed Items

According to the design and technical proposal.

5.1.9.6.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.9.6.3 General Technical Description

This type of conveyors will be used as an accelerating belt in order to feed the optical sorters.

They will be very fast and efficient conveyors.

The high-speed conveyors shall be brand new, unused.

5.1.9.6.4 General Technical Specifications

5.1.9.6.4.1 Carrying Structure

The chassis or frame of the conveyor will be built with folded sheet profiles with a thickness of 3 mm, reinforced with tubular struts, forming a rigid unit of great resistance.

In its front and rear part, the design allows the lodging of the drive and tightening mechanisms.

5.1.9.6.4.2 Conveyor Belt

The conveyor belt is made up of various layers of synthetic fiber fabrics of polyester-nylon, of high resistance with a covering of grease- and oil-resistant material (acrylonitrile) of type EP 400/3, 2:0 mm.

5.1.9.6.4.3 Drive

Geared motor with hollow shaft, fixed directly on the shaft of the cylinder and supported with a reaction arm which has shock-absorbing plugs to avoid possible vibrations of the group.

5.1.9.6.4.4 Head / Drive Pulley

It is made up of an appropriate diameter drum, convex on its ends, covered with rubber engraved in diamond shape of 8 mm in order to avoid slipping and / or the displacement of the belt.

5.1.9.6.4.5 Tail Pulley

It is made up of an appropriate diameter drum, convex on its ends in order to avoid the displacement / slipping of the belt.

5.1.9.6.4.6 Tightening

The tensioning system of the belt is done by means of two screws that are guided by bearings support, on a reinforced structure with UPN profiles.

5.1.9.6.4.7 Upper Displacement Deck

Displacement on sheet.

5.1.9.6.4.8 Return Roller Stations

Built with small plates with lodgings for the shafts of the rollers of heavy series with grease-resistant cleaning rings.

5.1.9.6.4.9 Guiding Channels

The guiding channels are built with steel sheets with a thickness of 3 mm, supported by small plates that are screwed to the chassis of the conveyor. The channels are furnished with rubber parts (lateral skirts) for the adjustment on the belt, they are not so hard, adjustable and interchangeable.

5.1.9.6.4.10 Cleaning Scrapers

This type of conveyors incorporates two scrapers; one scraper for the outer part of the belt, adjustable in height and working angle, which is located at the lower part of the motive cylinder.

The other scraper, with a triangular shape, is installed on the tensile cylinder, made of black rubber of 60 shores on the interior side of the belt, thus avoiding that objects can penetrate between the cylinder and the belt.

For reversible belts two inner scrapers shall be used.

5.1.9.6.4.11 Conveyor Supports

The support bases of the conveyor are built with UPN or other profiles and have an adjustable base in order to be able to level them according to the needs of the pavement.

The support base of the blowing valve blocks and compressed air adjusting elements for the optical sorter are attached to the front support.

Special support of the scanner and control units.

5.1.9.6.4.12 Discharge Hopper

The discharge hopper is placed at the lower part of the box and is made of 3mm-thick metal sheet. It is designed to collect the material cleaned by the scrapper and the different material blown by the optical sorter.

5.1.9.6.4.13 Protections

In order to avoid accidents, the tensile cylinder has an outer protection.

5.1.9.6.4.14 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- N Primer: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 µm of dry layer thickness for each layer
- N Top coat: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 µm of dry layer thickness for each layer
- N Total layer thickness: min. 160 µm dry layer thickness

5.1.9.7 Two Way (Revolving) Belt Conveyor

5.1.9.7.1 Installed Items

According to the design and technical proposal.

5.1.9.7.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.9.7.3 General Technical Description

The main feature of the two way - revolving conveyors is that the belt slides on the upper roller stations in form of a trough. The conveyor is reversible and has a drive to turn and distribute the material.

5.1.9.7.4 General Technical Specifications

5.1.9.7.4.1 Carrying Structure

The chassis or frame of the conveyor will be built with metallic profiles type UPN or other, reinforced with tubular struts, forming a rigid unit of great resistance. In its front and rear part, the design allows the lodging of the drive and tightening mechanisms.

5.1.9.7.4.2 Conveyor Belt

The transport belt is made up of various layers of synthetic fiber fabrics of polyester-nylon, of high resistance with a covering of grease- and oil-resistant material (acrylonitrile) of type EP 400/3, 4:2 mm.

5.1.9.7.4.3 Drive

Geared motor with hollow shaft, fixed directly on the shaft of the cylinder and supported with a reaction arm which has shock-absorbing plugs to avoid possible vibrations of the group.

5.1.9.7.4.4 Head / Drive Pulley

It is made up of an appropriate diameter drum, convex on its ends, covered with rubber engraved in diamond shape of 8 mm in order to avoid slipping and / or the displacement of the belt.

5.1.9.7.4.5 Tail Pulley

It is made up of an appropriate diameter drum, convex on its ends in order to avoid the displacement of the belt.

5.1.9.7.4.6 Tightening

The tensioning system of the belt is realized by means of two spindles guided by bearing supports, on top of a structure that is reinforced by U profiles.

5.1.9.7.4.7 Upper Roller Stations

They are built with small plates with lodgings for the shafts of the three carrying rollers. These form a trough at 30° (general rule), for the corresponding belt width, with its respective cylinders of heavy series.

5.1.9.7.4.8 Return Roller Stations

They are built with small plates with lodgings for the shafts of the rollers of heavy series with grease – resistant cleaning rings.

5.1.9.7.4.9 Guiding Channels

The guiding channels are built with steel sheet with a thickness of 3 mm, supported by small plates screwed to the chassis of the conveyor. The channels are furnished with rubber parts (lateral skirts) for the adjustment on the belt, they are not so hard, adjustable and interchangeable.

5.1.9.7.4.10 Cleaning Scrapers

This type of conveyors incorporates two scrapers; one scraper for the outer part of the belt, adjustable in height and working angle, which is in the lower part of the motive cylinder.

The other scraper, with a triangular shape, is installed on the tensile cylinder, made of black rubber of 60 shores on the interior side of the belt, thus avoiding that objects can penetrate between the cylinder and the belt.

For reversible belts two inner scrapers shall be installed.

5.1.9.7.4.11 Conveyor Metallic Supports

The support bases of the conveyor are made of appropriate dimensions UPN profiles, which have an adjustable base in order to be able to level them out according to the needs of the pavement.

5.1.9.7.4.12 Discharge Hopper

The discharge hopper will be manufactured by laminated sheets with a thickness of 3 mm. It will be designed to collect the material that is “cleaned” by the scraper.

5.1.9.7.4.13 Protections

In order to avoid accidents, the tensile cylinder will be protected / covered. If the conveyor has a maintenance walkway, an emergency stop with a cable pull shall be installed.

Lower covers of the conveyor up to a height of 2.50 m from the floor.

5.1.9.7.4.14 Conveyors with Steep Slope

If the conveyor has a steep slope ($> 20^\circ$), a belt with profiles shall be installed, lower cylinders without cleaning rings, scraper with brush and motor with brake.

5.1.9.7.4.15 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N	Primer:	2 layers of a 2 component polyurethane primer
N	Layer thickness:	40 μm of dry layer thickness for each layer
N	Top coat:	2 layers of a 2 component polyurethane primer
N	Layer thickness:	40 μm of dry layer thickness for each layer
N	Total layer thickness:	min. 160 μm dry layer thickness

5.1.10 Optical Sorters (NIR)

5.1.10.1 General Technical Description

NIR optical sorters will be used to separate different types of plastics (Mixed plastic and PVC).

Optical separators will be installed in order to separate and recover streams of plastic with high purity to ensure their commercial value.

Separation is performed by reading and processing the near infrared and visible light spectrum of the materials. The optical separation system must be particularly flexible in recognition and separation of materials with a wide range of impurities in order to select and separate the minimum impurities and therefore minimize the odorous materials.

In order to achieve this goal, the supplied software database for tracking, selection and segregation that will accompany the machinery must be extensive and has been used in the processing and separation of mixed municipal waste recyclables process lines.

An integrated optical separation device consists of the following basics parts:

- (a) The material transfer conveyor which, as its main features, has high speed and enough width for the materials to be disposed to be spread along its width satisfactorily. This point contributes decisively to achieving high recovery and purity rates of recyclable materials as it facilitates identification of target materials and there is no interference in the spectrum recorded due to overlapping of materials between them
- (b) The radiation detection system at infrared wavelength consisting of the source of radiation, the reflected polygonal mirror, the detector and the spectrometer. The above are installed in a single metal structure placed above the carrying conveyor
- (c) The material separation system (recovered / non-recovered) consisting of a high-pressure air jet valve assembly, installed at the end of the feeding conveyor.
- d) The automation, control and programming system of the device, placed in a single metal structure.

During its operation, the type, location and area of each material passing through the feeding conveyor through the above installed detector must be identified. Then as the material reaches the edge of the conveyor, the desired materials are recovered from the main flow of the material by repulsion due to the blowing of a high-pressure air through a pneumatic valve array.

5.1.10.2 General Technical Specifications

5.1.10.2.1 Installed Items

According to the design and technical proposal.

5.1.10.2.2 Capacity

According to constructor's technical proposal and mass balance.

5.1.10.2.3 Technology

These optical sorters will be equipped with NIR technology: «near infrared spectrometry». A calculation mode coupled to this technology will allow high quality results.

This system allows to detect the objects as per the materials nature, except for the black or very dark elements. The supplied computer's program must allow to carry out a separated or simultaneous sorting of different materials.

The optical sorting system incorporates an optimized detection technology without contact and of automatic ejection of the materials.

5.1.10.2.4 Detection

The developed capacities of these units must allow:

- N A constant and homogenous lighting, which makes the adjustment of the device very stable.
- N A great measuring speed.
- N Analysis resolution: 1cm²; analysis made on the complete width of the belt.
- N The analysis will be concentrated on the line spectrum 1, allowing a better detection of the materials.

5.1.10.2.5 Materials Sorting NIR System

Minimum size of the ejection objects	10 x 10 mm
--------------------------------------	------------

5.1.10.2.6 Ejection

The conception of these machines allows a controlled ejection of the detected objects thanks to:

- N A high precision synchronization (millisecond) between detection line and ejection bar
- N A minimum distance between detection line and ejection bar: 15 cm. This allows an optimized ejection efficiency of the rolling objects on the belt
- N Small distance between air nozzles: approx. 25 mm

5.1.10.2.7 High Resolution Detection

For the precise detection of weak fractions:

- N Great measuring speed
- N Increase of detection resolution
- N Minimum size of the ejection objects 4 x 4 mm

For those machines developed to eject weak fractions:

- N A minimum distance between detection line and ejection bar: 15 cm. This allows an optimized ejection efficiency of the rolling objects on the belt
- N Small distance between nozzles: 12,5 mm

5.1.10.2.8 Support Structure

The support structure is built with laminated steel profiles type HEA or similar, screwed between themselves and united by struts, forming a rigid construction without bending.

It has maintenance walkways and access stairs with banisters around the equipment.

5.1.10.2.9 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- N Primer: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 µm of dry layer thickness for each layer
- N Top coat: 2 layers of a 2 component polyurethane primer
- N Layer thickness: 40 µm of dry layer thickness for each layer
- N Total layer thickness: min. 160 µm dry layer thickness

5.1.11 Air Supply System – Air Compressors

5.1.11.1 General Technical Description

Screw type air compressor system consisting of compressors, integrated refrigeration type air dryer, pre filter, air vessel, etc. is required to supply dry and filtered air to the optical sorting systems and any other equipment that needs air for its operation (bag filters, etc.).

The whole system must be capable to supply clean air according to the proposed by the constructor facility needs.

The number of the air compressors will be determined by the constructor but in any case, there will always be one stand-by unit.

The air supply system shall consist of brand new, unused equipment.

5.1.11.2 General Technical Specifications

5.1.11.2.1 Screw Type Air Compressor:

N Screw Type Air Compressors capable of supplying compressed air to the optical sorters and any other machine.

Every compressor will be powered by a 3 phase A.C. electric motor of suitable rating and will be a complete system with:

- a) Receiver Tank fitted with Safety Valves, pressure gauge, and drain valve.
- b) Pressure Relief Valve,
- c) Automatic Pressure Switch,
- d) Suction Filter,
- e) Oil Sight Glass,
- f) Drain Valve,
- g) Non-Return Valve,
- h) Starter for the motor.

N Air delivery: According to facility's needs and constructor's design

N Working pressure: According to facility's needs and constructor's design.

N Receiver Air tank capacity: According to facility's needs and constructor's design

N Compressors should be designed for continuous duty and fitted with Deep finned cast iron cylinder with Aluminum cooler tubes and Low wear stainless steel Valves.

N Maximum noise level of compressor should be 70 dB (A) at normal load condition, one meter away from the machine.

5.1.11.2.2 Integrated Refrigeration Type Air Dryer

Compressor Unit should have an integrated Air-cooled Refrigeration type Air Dryer with Moisture Trap (with automatic and manual drain), suitable for above mentioned applications. Hot gas bypass valve should be provided to maintain a stable pressure dew point (2°C to 3°C) & avoid freezing during extended un-load run operation. Air dryer should be able to deliver compressed air to the machine according to ISO – 8573-1 having the following parameters of air:

- Solid particles / dust: Class – 1
- Humidity: Class – 4
- Oil content: Class – 1

5.1.11.2.3 Pre-Filter

A suitable and efficient Pre-Filter for Compressor Unit as per the requirement mentioned above for oil & other foreign particles removal from air.

5.1.11.2.4 Control Panel

Control panel for monitoring continuously & accurately (through microprocessor-based Regulator and Electronic Controller) the data and for controlling the performance through feedback to the operator and interlocking arrangements. Built in protection systems, inclusive the following, should be provided for safe and foolproof operation of the complete compressor system.

- a) Phase sequence protection relay,
- b) Phase failure protection relay,
- c) Motor overload Trip,
- d) High Air / Oil Discharge Temperature Trip.
- e) Protection against starting on load,
- f) Suitable for controlling the compressor operation Locally, Remotely or via. Local Area Network.

5.1.12 Sorted 2D Material Fine Shredder

5.1.12.1 General Technical Description

During the recycling process the fraction with a high calorific value is separated from the commercial waste and turned into a marketable product. Depending on the calorific value and the granular size, these fuels are used in fluidized bed combustion, cement plants and substitute fuel power plants. The collected stream must be shredded before it will be transported.

The shredder must be suitable to produce a fine shredded material (size approx. 30mm). The shredder will have been developed for the post-shredding of fraction with high calorific value. The width of the blades, the tooth shape, the number of teeth per blade and their arrangement on the circumference will determine the performance characteristics of each cutter.

The equipment will have a rotor (or two according to manufacturer) that turns at a low speed and it is driven by means of an electric motor. The transmission system consists of a hydraulic pump and a clutch (planetary type) or other according to the manufacturer (e.x. direct drive with frequency converter, etc).

The rotor/s incorporate/s a series of tearing teeth, located in a spiral form along its complete surface, which open the bags by tearing them against some fixed teeth. The distance between the teeth of the rotor and the static teeth will be adjustable by means of a hydraulic system.

The shredder shall be brand new, unused.

5.1.12.2 General Technical Specifications

5.1.12.2.1 Installed Items

At least one shredder will be installed.

5.1.12.2.2 Capacity

The shredder must have a minimum capacity according to constructor's technical proposal and mass balance in order to be able to treat the whole produced quantity.

5.1.12.2.3 Loading Hopper - Feeder

- N Constructed from metal sheets of > 4mm thickness and the appropriate reinforcement
- N Dimensions according to contractor's design & calculations
- N Effective volume of the hopper according to contractor's design & calculations

5.1.12.2.4 Drive System

- | | |
|-----------------------|-------------------------------|
| N Type: | Asynchronous motor – min. IE3 |
| N Speed: | approx. 1480 rpm |
| N Voltage: | 400-690 V |
| N Frequency: | 50 Hz |
| N Motor protection: | PTC |
| N Type of protection: | IP 55 |

The drive system is composed of (indicatively):

- N 2 Hydraulic pumps.
- N 1 Hydraulic motor.
- N 1 Planetary reduction gear.
- N 1 Crushing drum with tools that are highly resistant to wear.

Other drive system can be used, according to the manufacturer.

5.1.12.2.5 Shredding System

The shredding system has the following main characteristics (indicatively):

- N Hydraulic drive with automatic power regulation
- N Drum speed adjustable in a progressive way, without steps
- N The reverse cycles of the drum can be preselected
- N Rotor speed approx. 20-40 rpm

Other shredding system can be used, according to the manufacturer.

5.1.12.2.6 Safety and Cleaning Systems

In order to be able to clean the rotor of the equipment in a safe and ergonomic way, there will be a lateral gate which allows access in the inner part of the equipment with maximum reliability and comfort.

In order to avoid the gate opening during the operation of the equipment, there are some pins which prevent the counter comb from opening and support it when it is open.

5.1.12.2.7 Switchboard and Controls

These are made up of a main switchboard which is lockable externally, inverter, and motor protection in case of temperature increase (PTC) and high voltages.

- N PLC with 7'' touch screen
- N Emergency stop button
- N Protection:IP 55
- N Signal exchange via potential-free contacts

5.1.12.2.8 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

- | | |
|--------------------------|---|
| N Primer: | 2 layers of a 2 component polyurethane primer |
| N Layer thickness: | 40 µm of dry layer thickness for each layer |
| N Top coat: | 2 layers of a 2 component polyurethane primer |
| N Layer thickness: | 40 µm of dry layer thickness for each layer |
| N Total layer thickness: | min. 160 µm dry layer thickness |

5.1.13 Flip flop separator

5.1.13.1 General Technical Description

The flip flop separator must perform an effective separation of the small particles that are contained in the incoming stream according to its different physical characteristics and especially the size of the incoming material. Efficient screening of difficult, sticky or wet materials with separation cuts of 0.2 up to approx. 50 mm. must be succeeded. The flip flop screen (or other similar screening machine that the contractor will propose) will be used in order to remove all material with a size of < 20 mm like ash, sand, gravel, etc, in order to protect the anaerobic digestion facility from the entrance of unwanted materials and from clogging.

The constructive system of the flip flop screen will be based on a structurally reinforced chassis, with flexible polyurethane meshes mounted transversally in relation to the longitudinal axis of the screen and operated by motor vibrators. It is preferred to incorporate a design that no

nuts or bolts will be required to install the meshes. The power and range of the motor vibrators fitted tighten and slacken the meshes, generating a wave movement, which mixes, moves and screens the most difficult materials to classify and clean.

The flip flop screen classifies the flow of material into two fractions:

- N the undersize (sieved) fraction with a size of $< 20\text{mm}$ and the
- N oversize fraction with a size of $> 20\text{ mm}$.

In general, this type of equipment is particularly suitable for the separation of sticky materials such as:

- N waste concrete
- N meat flour
- N paper paste
- N plastic recycling
- N glass
- N USW
- N CDW
- N compost
- N and, in general, products that are difficult to screen.

The flip flop screen (or other similar proposed screening machine) will be used in order to remove all material with a size of $< 20\text{ mm}$ like ash, sand, gravel, etc, in order to protect the anaerobic digestion facility from the entrance of unwanted materials and from clogging.

The flip flop screen classifies the flow of the material into two fractions:

- N the undersize (sieved) fraction with a size of $< 20\text{mm}$ and the
- N oversize fraction with a size of $> 20\text{ mm}$.

The undersize fraction will be considered as rest material and will be transferred to the sanitary landfill.

The oversize material will be transferred to the dry anaerobic digestion facility.

The equipment will also incorporate an upper soundproof cover, the appropriate cleaning and, maintenance access to the main components (motors, shafts, mesh deck, etc.).

The flip flop screen (or other similar separator) shall be brand new, unused.

5.1.13.2 General Technical Specifications

5.1.13.2.1 Installed Items

According to the design and technical proposal. At least 1 flip flop screen (or other similar screening machine) will be installed.

5.1.13.2.2 Capacity

According to constructor's technical proposal and mass balance.

The number of decks (one deck or multi-deck version) will be decided from the contractor according to the needs of his calculations and design and the selected manufacturer.

5.1.13.2.3 Dimensions

Length:	According to manufacturer & design demands
Width:	According to manufacturer & design demands
Height:	According to manufacturer & design demands
Weight of the equipment:	According to manufacturer & design demands
No of decks:	According to manufacturer & design demands

5.1.13.2.4 Screening mesh

Mesh material:	Highly resistant flexible, self-cleaning PU or other according to the manufacturer
Mesh width:	According to manufacturer
Mesh length:	According to manufacturer
Screening holes:	20 mm is proposed or other according to the contractor's design and proposal
Screen gradients degrees:	5-20°

5.1.13.2.5 Motor and Transmission

Type:	Geared motor – IE3
Motor brake:	Brake in the motor of the motive shaft
Power:	According to manufacturer
Drive type:	According to manufacturer
Motor location:	According to manufacturer

5.1.13.2.6 Metallic Hoppers

The flip flop separator will be equipped with three hoppers (one for each separated fraction and one for the incoming material) in order to lead the discharged material on the belt and prevent material from falling on the pavement. The hoppers are manufactured with steel sheet of 3 mm thickness, fixed to the structure of the flip flop separator and once the belts for the collection of the exit materials have been installed, the hoppers are adjusted to them to guarantee the safety and cleaning of the process.

The measures of the exit hoppers are the following:

N	Hopper for the incoming material:	According to design & manufacturer
N	Hopper for < 20mm fraction, sieved material:	According to design & manufacturer
N	Hopper for >20mm fraction, oversize material:	According to design & manufacturer

5.1.13.2.7 Upper Cover

The flip flop separator will be covered with an upper cover of sandwich-type panels or other type that will be able to reduce the noise which can be caused by the material that is treated and prevents objects from being thrown outside of the machine.

5.1.13.2.8 Support Structure

The support structure will be built by laminated steel profiles type HEA or similar, screwed between themselves and united by struts, forming a rigid construction without bending.

It incorporates maintenance walkways and access stairs with banisters around the equipment.

5.1.13.2.9 Paint

All the metallic parts will be sand blasted. After the sand blasting a double layer of coat primer will be applied and finally a double layer of Epoxy coat of the required color will be applied.

N	Primer:	2 layers of a 2 component polyurethane primer
N	Layer thickness:	40 µm of dry layer thickness for each layer
N	Top coat:	2 layers of a 2 component polyurethane primer
N	Layer thickness:	40 µm of dry layer thickness for each layer
N	Total layer thickness:	min. 160 µm dry layer thickness

5.2 Anaerobic Digestion Facility Technical Specifications

5.2.1 Introduction

The term "Anaerobic Digestion" refers to the controlled biological degradation of organic waste under oxygen deficiency conditions (anaerobic conditions) and leads to the production of biogas (a mixture of CH₄ and CO₂ which can be used as a fuel for cogeneration of electricity and heat); and of a digestate. Anaerobic digestion involves biological processes that can be classified into four distinct phases:

- **Hydrolysis** of polymeric organic compounds (fats, proteins, polysaccharides) by means of enzymes released from hydrolytic bacteria and their conversion into water-soluble products of lower molecular weight (monosaccharides, amino acids, etc.).
- **Fermentation** of the above soluble products and their conversion to a variety of intermediate products, such as short organic acids, alcohols, carbon dioxide, hydrogen and ammonia.
- **Acidogenesis**, namely production of acetic acid, carbon dioxide and hydrogen from the products of the previous stage with the help of obligatory acidogenic bacteria. In this phase, carbon dioxide is the main component of biogas. (pH: 4.5 - 6.5)
- **Methanogenesis**, during which the products of the previous phase are converted into methane and carbon dioxide from methanogenic bacteria. (pH: 6.8 - 7.2)

5.2.2 Technology

The anaerobic digestion technology of the organic fraction will be that of the anaerobic digestion of intermittent process. In this technology, the material is introduced into the reactors, which are then sealed. The material is extracted at the end of the process without introducing new material to the intermediate.

Loading and unloading of organics to anaerobic digestion reactors will be made with a loader.

The loading area and the preparation of the material for anaerobic digestion will be made in a closed building. Any mixing prior to anaerobic digestion will be accomplished by mechanical means.

The material will remain in the reactors for a period of at least 20 days. During this period removal of biogas to the gas holder and of process effluent to a tank or tanks will take place.

Part of the process liquids is recirculated in the reactor(s) to accelerate microbial activities.

The biogas produced from the process will be removed from reactors to the gas holder, from where it will be led for energy production. The storage of biogas in the gas holder will be carried out under low pressure.

Biogas production will amount to at least $90 \text{ m}^3 / \text{t}$ of material entering the reactor.

Ventilation with adequate air supply to each reactor will be possible both at start-up and before the unloading of material to remove any remaining biogas.

The amount of biogas produced, temperature and humidity inside the reactors will be monitored continuously.

To control the process, each reactor will be controlled by a programmable logic controller (PLC) which receives signals from the sensors and controls their operation. Temperature, pressure, pH, solids content, organic loading values, alkalinity, volatile fatty acids and biogas production in the reactors in which the fermentation process takes place will be continuously monitored

The PLC will be interconnected with the central control station located in the administration building, where it will be controlled by the SCADA telecontrol software installed on a PC.

The design of the anaerobic digestion facility will meet the following basic principles:

- Anaerobic digestion will treat biologically the organic waste in a manner to ensure as low emissions as possible and the production of biogas of high energy content for energy recovery.
- Should the unit be shut down, it should be ensured that the bioreactor is properly unloaded from the content material
- The reactor should be equipped with all components necessary for its operation such as monitoring and operation systems.
- Reactor parts that come in contact with the organic waste to be digested, with the digestate residues or biogas must be made of resistant materials with high corrosion resistance.
- The reactors will be thermally insulated and will be airtight.
- There will be room for future expansion of the facility by adding enough reactors to treat up to 130,000 t/ year. The expansion site should be close to the original reactors to take advantage of the available infrastructure (process water, biogas, deodorization, etc.) that will be constructed for the project.
- The equipment configuration will be such as to ensure unobstructed access for inspection and maintenance.

5.2.3 Biogas Management

After its removal from the gas holder, the produced biogas will be forwarded for exploitation in a cogeneration power and heat generator.

The flow of the biogas produced shall be continuously monitored through a flow meter while its quality characteristics shall be monitored by recording the contents of CO_2 , methane (CH_4) and O_2 .

If biogas cannot be utilized in the cogeneration plant either partly or fully, the biogas will be diverted to a boiler with a dual fuel burner (diesel-biogas) in order to exploit its thermal energy in the heating of the anaerobic treatment cells, whereas there will be also be the possibility of partial or total diversion of biogas to the flare of the facility to burn potential surplus quantities of biogas or all the produced quantity in case of damage or maintenance.

An indicative composition of biogas produced in Anaerobic Digestion is presented in the following table:

Table 5-1: Qualitative composition of biogas (BREF, 2006)

Component	Concentration (vol. %)
CO ₂	25-50
Methane (CH ₄)	50-75
Humidity	6-6.5
O ₂	0.9-0.11
N ₂	3.9-4.1
H ₂	
H ₂ S	<0.1-0.8
Ammonia	<0.1-1

The biogas utilization facility consists of the following:

- Suction pump (blower) for pumping biogas from the gas holder
- Condensate trap
- Dehumidifier
- Biogas measurement device (temperature, humidity, content)

Depending on the facility's needs, the biogas is then fed into the boiler or the flare or the co-generation generator.

The cogeneration generator includes:

- Suction pump
- Internal combustion engine
- Electric Generator
- Heat exchanger fed by the cooler of the Internal Combustion Engine and / or its exhaust gas

The generated electricity is produced at a voltage of 400V and therefore it is necessary for its distribution to the grid to raise the voltage to 20kV through a transformer substation with a voltage transformer and a medium voltage distribution board.

The generated thermal energy is pumped by a circulator into the hot water recirculation network of the anaerobic treatment reactors together with the hot water from the heat exchanger

of the boiler. The individual respective hot water flows supplied to the circuit are automatically adjusted by the automation system.

The following specifications will be met by the biogas exploitation facility:

- If the produced biogas cannot be exploited, the boiler and / or the flare should be activated automatically.
- It must be ensured with suitable sensors that there will be no biogas leaks from the reactors.
- Operation of the generator will be automated and will be equipped with all the necessary monitoring and control systems.
- The facility's configuration will be such as to ensure unobstructed access for inspection and maintenance.

An emergency combustion will burn the biogas excess, in a situation where the gas engine will not operate due to maintenance or deterioration. In emergency burning process (flare) the gas produced in the tunnels is burned safely to the atmosphere without causing any emission. The gas combustion chimney to be used is automatically controlled and has low gas emissions. The start / stop command of the facility will be activated, and it will start automatically by opening the related valves and ignition systems. The flame will be continuously monitored with a UV sensor in the combustion chamber. The start or standby command of the chimney will be monitored.

It is noted that for phase 1, a flare of 500 m³/h is required, whereas for phase 2, an additional flare of 1,000 m³/h is required.

The technical features of the flare unit to be used in the facility are given below.

- Combustion temperature: 800°C
- Methane content: 35-95% CH₄
- Gas pressure: Min. 20 mbar (without compressor) / Min. 1 mbar (with compressor)
- Connection: DN50-DN250
- Ignition: 10 kV
- Combustion control: UV Sensor

5.2.4 Fermented Materials Storage

The solid fermented material from the anaerobic digestion will be unloaded after the completion of the process and it will be sent for disposal to the landfill. The transportation will be made using open trucks, which will be loaded using a wheel loader. In case that this is not possible, the solid fermented material will be stored in the specially designed storage area for this purpose. The storage area should be able to store the solid fermented material for at least 30 days. Aim of the building is to store the fermented product in a way that it will not be affected by meteorological events.

The closed solid fermented material storage building shall have an air collection system with air exchange of 2 times of the total air volume. The collected air shall be further treated in the AD's deodorization system.

As for the liquid fermented product, it will be stored in tanks that will have sufficient volume to store it for at least 30 days.