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Østfold Avfallssortering IKS - MRF

Title:

APPENDIX A6

GENERAL MECHANICAL REQUIREMENTS



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1 GENERAL

All machinery and equipment must be new.

Contractor must keep in mind, that no loads can be put on the civil steel structure and concrete walls.

All installations have to be done at Contractor's own steel construction!

In Contractor's design process, the following factors shall be taken into account:

- Ability to provide separate models for primary support steel/footprint positioning in order to more easily interact with the civil consultant
- Ability to take out simplified/stripped down models as the geometry is the most vital for the construction work.

In material choices, main attention shall be paid to compatibility of materials and operating conditions. Also mechanical, manufacturing and maintenance characteristics (e.g. strength and endurance) of materials shall be considered as important criteria of choice. The machinery and equipment to be chosen shall be standardized and operational experience on these materials will be advantageous.

Special attention shall be paid to prevent corrosion and abrasion in chutes and conveyors in contact with waste.

The requirements of standards, rules and recommendations shall be fulfilled in the supply of the equipment in following order of priority, if not otherwise stipulated in the requirements:

- Harmonised EN standards
- EN standards in general
- DIN standards in general

If above mentioned standards or Contract are not covering some specifics of the plant, then Contractor may use, after Client's approval, other applicable standards.

Contractor shall provide the plant with required CE-markings and be included in the scope of work.

2 MATERIALS / WORKMANSHIP

All parts included in the scope of work, both as regards to material and execution of the work, must be of first-class quality. Materials best suited for the purpose shall be used.

The choice of material for major machinery and equipment shall be specified.

In particular, the chosen materials should provide the best possible protection from corrosion and wear. Client shall approve materials for use in high corrosive and abrasive areas.

Under no circumstances must materials be used which contains asbestos.

During fabrication and erection, Contractor shall check and control that the chemical composition and structure of the materials are not changed in such way that the specified requirements no longer are fulfilled.

2.1 Surface treatment

All surfaces of the supplied machinery and equipment must be properly protected against corrosion. The corrosion protection shall be of a high standard.

A warranty shall be given in respect of the surface treatment, to the effect that two years after take-over, the rust attack shall be maximum Ri 1 per ISO 4628/3.

2.2 Painting – work

Contractor is responsible for choosing the right painting throughout the plant to avoid damages by acid spillage, corrosion, damage by temperature and mechanical influence. All surfaces shall be easy to clean.

If possible, only one paint system shall be used for the complete plant, and the manufacturers recommendations shall be followed carefully through the whole painting process.

All coating shall be applied with noticeable difference in colour for each layer, and each application shall be executed through to the full covering of the previous coating.

All coating shall be performed in a manner that ensures complete tightness of the coating. Defective adhesion, air pockets and inclusions of foreign particles shall not occur.

Machinery and equipment to be coated shall have no sharp corners and otherwise be suitable for the required kind of corrosion protection.

The following painting system shall be applied for the not-insulated surfaces:

According to DIN EN ISO 12944-5:2017
Corrosion class C3H for indoor installations
System no.: Appendix table A.1 / System A1.17 (160 µm)

Corrosion class C4M for outdoor installations
System no.: Appendix table A.1 / System A1.19 (200 µm)

For feeding conveyors corrosion class C4 shall be used.

Surfaces to be insulated shall be shop primed.

2.3 Hot-galvanising

Grates in stairways, gangways, steel structures, cast parts, including foundation anchors and edge irons in recess and similar (nuts, bolts and washers) shall be hot-dip galvanised in accordance with ISO 14713, 1-2: 2017/2019.

2.4 Vibrations

Machinery and components shall be designed in a way that no vibration can cause problems to the installed machinery or equipment, personnel or building structure. Vibration shall be no more than according to class A “good” in ISO 10816. Vibration and balancing data shall be specified for the machinery and equipment. Vibrations transferred to the building shall not exceed requirements in DIN 4150, part 3.

2.5 Insulation

Insulation has to be designed and provided as per the relevant rules and regulations.

Where the insulation is discontinued, for instance at connections, the cladding shall be designed so that water cannot penetrate into the insulation.

Where required for inspection and maintenance, the covers and the insulation shall be easily removable.

Maximum outside temperature on insulated hot surfaces shall not exceed 50°C.

2.6 Structural Steel, Platforms, Walkways and Stairs (called “Steel Structures”)

All steel components shall be designed according to relevant laws, standards and directives of Norway and the EU. Especially the particular legislation on personnel safety must be observed.

All steel structures required for installation and support of the machinery and equipment, and its auxiliaries – piping, ducting and cables, etc. should be included:

- All steel structures, grating, hand railing, kick plates for floors, platforms, stairs, ladders, for supporting of all auxiliary equipment supplied and installed by Contractor and as required for easy access, operation, maintenance and repair of the machinery and equipment as well as for safe escape from the plant
- All grouting of steel structure bases and all metal parts which either rest on or penetrate through floors
- The de-dusting system of the plant, and all steel structures for supporting the pipelines and ducts

All structural design, calculations and engineering drawings for the steelwork must be prepared and approved by a professional engineer. No work shall be allowed to

commence on site before the approved documents have been submitted to Client, including a detailed description of the methodology for implementation of the construction works and its approval by Client.

The steel construction shall form a self-supporting, stable construction without imposing horizontal forces on to the adjacent buildings- or building structure and have a minimum of supporting legs on the ground floor.

The steel structures, cross beams and bars near the ground floor should have a minimum clear distance to ground floor of 2000 mm for better cleaning possibilities. Areas with less clear distance to be approved by Client.

The steel structures shall be designed to support the machinery and all other equipment supplied under this contract, as well as loads and forces resulting from the weight of various items of machinery and equipment (screens, NIR machines, conveyors, stairs, etc.) placed on the steel structure. After final positioning and aligning of the supports, all bearing pads, saddle blocks, etc. shall be secured to the main steel structures. The steel structure shall also be designed to support the hoisting equipment needed to carry out the planned service and maintenance work.

Contractor shall in the stress analysis take into consideration all dead loads arising from his supplies as well as all live and dynamic loads.

Platforms shall have a width securing free space of minimum 1,0 m. The design load for all platforms shall be min. 2.5 kN/m² or higher when required due to additional load during maintenance and replacements for spare- and wear parts. No stairs shall have an inclination of more than 38°. Step rise approx. 180 mm according to EN ISO 14122:2016. Vertical ladders shall be avoided but can in special cases be approved by Client.

Embedded items like bolts for chimney and pit protections, steel cladding etc. shall be delivered by Contractor.

Steel structures shall be designed to avoid the inducement of vibration to the steel structure by the moving- and vibration-creating machinery and equipment.

After erection, all damages to the steel structures caused by transport, storing and handling, hot work, etc. shall be repaired as directed by Client.

2.7 Hoisting equipment

All hoisting facilities, i.e. cranes, tackles, hoists including running beams and travelling trolleys necessary for the dismantling and maintenance of components within the works shall be supplied marked with SWL (Safe Working Load), assembled, tested, certified and handed over in accordance with appropriate Norwegian standards.

All larger components, which may have to be taken out for service or maintenance shall have proper lifting facilities available by means of an approved support beam or similar arrangement. Max load without crane/lifting coverage is 25 kg.

2.8 Lubrication

All flange mounted bearings shall be equipped with a lubricating nipple allowing the lubrication. All lubrication nipples shall be easy reachable from platforms or floor level. If not, an extension pipe or an automatic lubrication system shall be used. The extension pipe or the automatic lubrication system shall be marked with the corresponding machine/part number(s) (AKS-number) they are serving.

Encaged lubrication points must be connected to automatic lubrication system or have separate hose to collecting point for easy access.

As a minimum, the following machines shall have a local central lubrication system with electrical pumps:

- Shredder
- Baler

3 SPECIFIC REQUIREMENTS MACHINERY

3.1 General

The following description is based on the description in Appendix A3 and attached block diagram. However, the Contractor shall base his solutions on his own experience and may propose alternative machines and equipment.

All machines and equipment must be of a simple, but very robust design to cope with the anticipated operating conditions and the used materials must be suitable for the described purposes. In addition to the above mentioned, the machines and equipment have to meet the following requirements:

- reliable, high availability
- wear-resistant
- with low energy demand
- low noise-generation
- do not transmit vibrations to the neighbouring equipment
- low dust emissions
- designed to prevent blockages and twining
- high degree of safety

For safety reasons, it is particularly important that all components are readily accessible for cleaning, inspections, and repair. They must be easily replaceable. The necessary installation and maintenance areas must also be sufficiently large enough.

A detailed description of all products and components must be submitted. Relevant parameters and the specific performance requirements are to be provided.

3.2 Hopper/ Feeding conveyor

The Hopper/ feeding conveyor is located raised in the reception hall. The conveyor shall as a basis be fed with an excavator with a sorting grab, and the hopper can be filled with material up to the surrounding wall level. Feeding of hopper with front wheel loader shall be possible.

3.3 Shredder

Feeding of the shredder will be done by the feeding conveyor and is to be fitted with a hopper for a sufficiently filling volume.

The shredder shall serve as a reliable system for opening of bags and secondly to shred the oversized waste to a particle size allowing the subsequent process to be operated under the guaranteed conditions.

The required throughput capacity and function must still be achieved, even at the end of a wear cycle of the cutting tools. Sufficient reserves should be provided for the throughput capacity.

The output quantity of the shredder has to be independent of the input material quantity. There shall be a homogeneous material flow at the output of the shredder in order to enable a proper function of the following process steps.

The system is to be equipped with safety clutches and an emergency-stop-system.

Input materials, such as metal wires, packaging bands and long pieces of materials, shall not cause any problems for the shredder, and they shall not affect the throughput capacity.

The shredder will need to meet the following basic requirement:

- Satisfactory capacity and even feeding of shredded material
 - Robust
 - Good accessibility as well as access for cleaning of the machine and cleaning of the floor underneath the shredder
 - Does not block easily
 - Low electrical operation power per ton
 - Low noise generation
 - Low dust emission
-
- The rotor has to be manufactured with suitable measures to protect against wear (e.g. welded edges of the knife holders, etc.). The wear protection must be readily renewable from the maintenance gate on the side of the machine.
 - Particular attention shall be given to ensure easy replacement of the rotors and access to all parts of the machine for maintenance.
 - The shredding area must be easy to open allowing foreign parts to be removed without great effort.

- Cooling and heating system and hydraulic powerpack to be located in such a way that it is protected from dirt and dust.
- The hydraulic powerpack should be delivered with an external oil cleaning / filtration device.
- The shredder must be equipped with a reversal operation mode that provides a certain number of reversal processes in the event of adverse or harmful materials. If the adverse material is not shredded and remains inside the shredder, the machine shall automatically be switched off. An error message is then sent to the control system and a visual warning signal is generated.
- A shredding system should be chosen in which the throughput capacity can be regulated via a control element from the PLC control (via bus system). The throughput of the device must be adjustable with the hydraulic system.

The shredder shall be equipped with local controls with the minimum of the following functions:

- Opening and closing of all maintenance openings
- Forward and reverse operation of the rotor
- Indication of malfunctions in text format
- Emergency stop
- Other functions that are required locally for maintenance and cleaning

The operator elements on the devices must be protected by locks to prevent operation by unauthorised persons.

All special tools for maintenance and repair are to be included.

Fire detection with deluge system

For fire protection, fixing point for the pipe of the deluge system for the hopper have to be offered. The deluge system has to flood the hopper with water in case of fire detection. A deluge system for the outgoing conveyor shall be included in the supply.

3.4 Drum Screens

For the screening with a lot of film fraction with large volume, two drum screens are foreseen.

For drum screens, a minimum inside diameter of 3.000 mm is required. The sizing calculation must be submitted to Client and will be checked for plausibility.

The scope of work for screening drums shall include, but not be limited to:

- drum cylinder with required internals
- screening section with replaceable, perforated plates, secured by screws
- robust steel frame with circumferential and axial rollers as drum support
- standardised, easily accessible drives
- inlet and discharge chutes as required, discharge equipment for screenings
- frequency converters
- connection to ventilation system with internals for forced ventilation

- maintenance doors (hinged on top and equipped with dampers) to secure easy access.
- platforms located in the best possible height for easy cleaning from the outside.
- devices for easy cleaning of wrapped material around the drum and protection against clogging of holes of the drum must be installed.
- light for CCTV camera inside

It is necessary to assume segregation of three fractions to get a good material split for the next separation steps:

- Fines, i.e. <xx mm
- Medium, i.e. xx - xx mm
- Large, i.e. xx - xx mm
- Oversize, i.e. >xx mm

Cut sizes to be suggested by Contractor.

The drum screens should provide the largest possible screening surfaces and permit changing of the mesh dimensions by changing the screen plates.

It is also necessary to install elements that will minimise the soiling, clogging of holes, twining of wires, cables, film, etc.

The drum sieve shall be mounted on a welded stable frame base made of steel equipped with dust elimination casing, lighting installation and appropriate safety equipment.

The screens shall be equipped with platforms, fitted at four sides to allow easy access during operation. The whole platform system shall be connected to the screens.

By construction of the screen, it is necessary to protect elements against abrasion inside the screen and in the discharge chutes.

All material connections shall be dimensioned sufficiently large to prevent blockages.

It must be possible to replace the individual screening plates at short notice with simple tools. The metal plates forming the discharge opening shall extend down to the discharge belt.

The installation of adjustable cleats, lifting bars, swords and similar must subsequently be possible without additional design effort, exceeding the already provided design in the proposed package.

The drum screens are to be encapsulated for dust proofing and provided with a suction device connected to the exhaust air treatment. Manholes/doors are to be dimensioned so that maintenance and repair work can be carried out smoothly.

A minimum size of 1.000 x 2.000 mm for the maintenance hatches at the side of the drum screen for cleaning is required. The access doors have to be hinged and a quick release lock system has to be mounted. The doors shall open upwards and held open by gas compression springs. It should be possible to secure the doors in open position to work safely during cleaning.

The door handles must be placed in such a way that one person can open each door.

The electrical interlocking of drum screens must allow operation for cleaning of the drum from the outside to ensure a continuous extraction of the cleaned material.

The discharge device for the individual fractions must not fall below an angle of 70° to the horizontal. The drum chutes have to be equipped with a painted base plate of 4 mm thickness and 10 mm rubber covering.

3.5 NIR machines

The NIR machines are to be supplied with the accelerator conveyor, base frame, scanner unit, valve block, housings of the valve block areas and analysing electronics.

The NIR machines are used for sorting out fractions of a specific material from the overall material stream. The most commonly available and long-lived lamps are to be used for lighting. The scanning system must be insensitive to dirt, low-maintenance and reliable.

An acceleration conveyor of sufficient width and length, and with adjustable speed, is to be provided for the material infeed. All acceleration conveyors have to be equipped with speed sensors.

An even loading and distribution is to be achieved in width of the belt and not as a surge. The units must be sized for loading of mostly monolayer fractions. The width of the conveyor belt has to be adapted to the detection device.

From the point of feeding of material to the acceleration belt and up to the scanning unit a distance of at least 4,0 m has to be foreseen.

The NIR machines must have a free space between the lowest part of the unit and the high-speed belt of min. 500 mm to prevent any blockage of waste with a particle size of up to 350 mm in two dimensions and no limit for the third dimension.

Ejection is in general to be achieved with a single-stage row of valve block.

The nozzles must be designed, or by upstream measures, such that cleaning is required only once per shift. The nozzle bars shall be designed swivelling and foldable with pneumatic cylinders for easy maintenance and cleaning.

A light barrier shall be provided in front of the nozzle bar of each NIR machine to detect blockages between belt and nozzle bar. If the light beam is interrupted for an adjustable time slot, an alarm signal shall be generated.

The separation zone is equipped with a splitter roll with vertical (+/- 200 mm) and horizontal (+/- 250 mm) adjustability. The uppermost point of splitter roll in zero point position of the adjustable range must be equal to the upper conveyor surface. The surface of the splitter roll has to be made of a suitable wear-resistant material. The splitter roll shall have a diameter of at least 150 mm.

The NIR machines shall include a solution that avoids wrapping around the splitter roll during operation.

The bearing of the separator and motor must be done outside the material flow. A sealed protection against wrapping of the shaft has to be installed inside the hood to the side walls.

Included with the acceleration conveyor is a sufficiently large volume hood for demobilization of the air-/waste-flow. The air exit region of the hood is to be covered with a screen mesh. The screen mesh is to be executed on the outside of the flight parabola.

The connection to the source extraction of air is to be designed so that film or other lightweight materials will not largely be discharged.

At each side and at the back of the hood; large hatches for cleaning purposes have to be provided.

Above the nozzle bar, the hood has to be designed of such a way, that waste particles are restrained there and do not contaminate the scanner unit or any other equipment of the machine. The intake part of the hood must be easy to clean.

Good access to the valve block for maintenance and cleaning is needed. One possibility is a door with a folding platform behind the splitter roll. A sketch with layout to show the access possibilities has to be included in the offer.

From the central PLC unit, it shall be possible to choose between defined pre-programmed sorting programmes for the NIR machines.

All grease points must be accessible without dismantling safety or protection equipment

The NIR-machines must, as a minimum, meet the following requirements:

- High ejection performance with a high level of accurate sorting
- Good accessibility
- Outputs for important operating indicators to control room
- Simple programmability of the fractions to be separated

3.6 Ferrous metal separators

Ferrous parts shall be extracted magnetically from the different fractions in the process.

The scope of work includes, but is not limited to, complete separation systems, in the necessary quantity for the following fractions:

- Fraction > xx mm
- Fraction < xx mm

To optimise its functioning, the installation of the separator should allow for repositioning both vertical and horizontal, by changing its sloping angle.

The ferrous metal separator shall be fitted longitudinally above the reloading point of the feeding conveyer and shall be adapted to the width of the belt.

Each magnet consists of a minimum of:

- separator block including material removal
- height-adjustable, vibration-free suspension of frame
- drive and transmission
- discharge chutes in non-magnetic design
- belt tensioning device
- operator guards
- equipment for belt change
- rubber lined chute for metals
- Safety markings

Spillages of waste at the discharge points shall be prevented.

Between the cleats, wear-resistant rubber pads are to be vulcanized.

Adequate widths of the ferrous metal separator (height-adjustable design) shall be adaptable to the changing conveying rates and speeds of the material flow for satisfactory removal of the ferrous scrap.

Only non-magnetic materials shall be used within the reach of the magnetic fields (especially applying to conveyor belt and chutes).

3.7 Non-ferrous metal separator

The non-ferrous metal separator is to be built as a mixed-pole separator, including material removal with a rotating separator, cover, vision ports and air vent hatch.

The non-ferrous metal separator has to have an eccentric pole system adjustable in angle and speed, variable belt speed and an adjustable separator.

An appropriate magnetic belt separator, operating on the principle of eddy currents, must be assembled on a steel structure and shall serve as a non-ferrous metal separator.

It shall be possible to switch off the separator independently to allow for continued operation of the remaining process.

The non-ferrous metal separators will be delivered with individual switchboard cabinets and control systems. For data exchange with the superior PLC and SCADA system, the recommended PLC has to be equipped with a fieldbus interface.

It must be possible to perform operation of the machine in automatic mode via the superior control system. All status signals and alarms from each machine shall be transferred to superior PLC and displayed on the visualisation.

Generally, all requirements and specifications in Appendices A7 'Electrical Equipment' and A8 'Control and Monitoring System' have to be considered.

3.8 Conveyors

The following minimum refers to all offered conveyor:

- conveyor belt
- carrying rolls with buffer rings and supporting rings
- support frame with supporting steelwork
- greased bearings
- electric motor with gear box
- material charging
- belt cleaning with scrapers (where applicable) or rotating brushes
- material guides
- belt guides and centring device
- automatic mechanical alignment correction for conveyors >15 m
- automatic mechanical or electro-pneumatic alignment correction for frequently reversing conveyors
- stationary equipment for repairs
- safety devices
- speed sensors for conveyors on each acceleration conveyor
- misalignment sensors for conveyors >20 m, if necessary
- ultrasonic level sensors at discharge points in containers, trucks or in storage boxes
- pull-wire emergency stop switches in front of dangerous transfer points
- all transfer point chutes with support structure, fully encased with access openings

To prevent spillage of waste on the belt side bars, the belts must be of sufficient width. Side bars must be adjusted to the material flow.

Appropriate sealing of the side bars shall be used. In drop areas, side bars with protection, approximately 3m, is considered sufficient (not over the whole length).

All smooth surface belt conveyors shall be equipped with scrapers. To prevent any soiling of the conveyor belts, self-adjusting scrapers shall be provided inside the belt at an appropriate distance from the point of discharge. Particular attention in order to provide easy access to re-adjust and cleaning of the scrapers shall be made.

The clear distance between the scraper and the back wall of the chute must be min 250 mm.

It must be possible to move the scraper away from the belt in an easy way from the outside of the chute (e.g. Fa. FTK Fördertechnik Kilian GmbH, Typ: FTK Master-Cleaner ("Schnellreinigungsabstreifer")).

Belts with cleats have to be cleaned by rotating brush cleaners or fitted with knock rolls. The remains must be dropped on an underlying conveyor if needed with chutes or, if this is not possible, led via a chute to the floor, where they can be collected in small containers. These containers will be moved and emptied with a forklift.

Easy access without risk to the personnel, even during operation, shall be ensured for purposes of cleaning.

All conveyors must be equipped with material guides.

It is necessary, for safety reasons, to fit in protective shields at lower rollers in easily accessible places and up to 2,5 metres height from the floor level or platform. These protective shields must be easy to disassemble with hinges at the upper side and screw at the lower side.

All carrying rollers shall be designed to prevent clamping on any object.

All lubrication points shall be easily accessible.

Chutes and hoppers shall be made of steel and be provided with easy to interchange hard metal screwed plates where abrasive material falls all the time to the chute plate. Noise-suppressing anti-drumming liners shall be integrated into the designs where steel meets steel.

The belt tension has to be adjustable without dismantling of the protection covers of the tensioning drum, so that an adjustment during operation is possible.

The construction of the conveyors should be designed for installation of additional equipment (such as: shut-down wires, standing or idle time sensors, rectilinear belt travel sensors, dust removal installations, elements covering the lower part of the conveyor). A system of additional holes should permit fit-in of additional elements of equipment without complications and extensive labour.

The conveyor supports should be made of stable steel profiles, connected at pivotal points with the conveyor structure and equipped with footing elements, allowing the adjustment of height for uneven flooring.

3.9 Belt Weight

Contractor shall propose number and location of necessary belt weights in the process.

All belt weights must be appropriate for the installation circumstances regarding the conveying speed, material flow and material density and shall be delivered with a suitable testing weight.

The measuring accuracy shall be better than $\pm 0,5$ % for the weighing cells itself and 2% for the complete weighing system in implemented condition.

For achieving optimal acquisition of data, influences from vibrating machines or steel structures of the plant and relative movement of material on the conveyors with belt weight must be avoided.

All electrical equipment of the belt weight like load cells, speed sensors and terminal boxes have to fulfil protection class IP 65 as a minimum.

The weighing terminal shall comprise the minimum of the following functions:

- Data interface for integration in the CMS network (Ethernet/Profinet preferred)
- Analogue output 4-20 mA for throughput in [t/h] (adjustable)
- Binary pulsed output for absolute weight in [t] (adjustable)
- Data storage possibilities for absolute weight
- Binary inputs for automatic tare adjustment, reset of data storages, live signal conveyor, etc.

3.10 Baler

The baler serves to compact the sorted recyclable material.

The baler shall include, but not be limited to:

- drive gearbox
- filling chamber with charging hopper
- hydraulic ram
- compaction box with compaction duct
- compaction cylinder with hard-chromed piston rod
- fully-automatic bale tying device
- horizontal and vertical (cross binding) system
- bale ejection equipment
- complete control cubicle, cabling, bale counter and device for measuring the bale length.

It shall be possible to vary the bale length and the degree of compaction by the means of different baling recipes, which can be activated from the bunker management system running on the central control system of the plant.

The baler shall have the possibility to use both steel wires and plastic wires.

The baler shall be provided with a cooling device. For the offered baler, only equipment which has proven itself in practice for the same, or equivalent, applications must be considered.

Processing requirements:

- the output capacity for materials weighing 25 – 50 kg/m³: min >15 t/h
- number of binding wires (vertical): min. 5
- number of binding wires (horizontal): min. 4
- bale chamber section: min. 1,1 m x 1,1 m
- Adjustable bale length: 0,7-1,4 m

The Baler control box should also include the following information:

- number of pressed bales for each material fraction
- bale length (bale weight)
- operating hours

The baler will be delivered with an individual switchboard cabinet and control system.

For the baler, the switchboard cabinet shall be placed locally besides the machine. For local operation, a touchscreen display has to be provided. From this touchscreen display, it must be possible to do all operations needed during adjustment and maintenance of the baler.

For requirements to electro and CMS, refer Appendix A7 'Electrical Equipment' and Appendix A8 'Control and Monitoring System'.

Collection of water and/or other spillage must be closely considered when designing the position and clearance.

A safe and non-interruptive system for taking out samples of the products shall be implemented. The plant should be able to run while doing sampling.

Fire detection with deluge system

For fire protection, fixing point for the pipe of the deluge system for the hopper have to be offered. The deluge system has to flood the hopper and compacting box with water in case of fire detection. A deluge system for the outgoing bales shall be included in the supply.

3.11 Bunker Management System

The content of each bunker shall be continuously monitored and with the user entered parameters (pressing time, material flow during discharge, bale length and end weight of bale) the bunker management system must be able to control the bunker discharge and the baler. The bunker content, the material flow and the calculated quantity of bales shall be available on the operator stations.

If the bunker capacity is nearly achieved and an integer number of bales for this material has been calculated by the CMS, the bunker management system shall send an order with the number of bales to be pressed together with the material information and the appropriate pressing recipe to the baler. Now the material will be discharged out of the bunker and pressed to bales. After finishing the last bale, the baler has to give the information back to the bunker management system that the job is done, the cleaning cycle can start, and the baler is ready for the next bunker to discharge.

Manual intervention and operation must be possible at any time. A cleaning cycle at the end of each discharge procedure shall clear all conveyors and the baler to avoid unwanted blending of bunker contents.

A deluge system will be installed over the bunkers, and the complete electrical installation in the area of the bunkers has to be water resistant and must fulfil at least protection class IP 65.

3.12 Storage solution for outgoing waste

3.12.1 General

Residual waste not sorted out as separate fraction shall be transported via conveyors to a storage solution for the outgoing waste stream.

The solution shall prevent the spread of spill, dust, and odour. In addition, it must be robust regarding fire.

The described solution in these documents is based on a stationary press container station. In addition to this solution, we will encourage the Contractor to propose a recommended alternative solution which can improve flexibility on short and long distance transport.

3.12.2 Press Container Station and containers

Containers with residual waste will be transported with trucks to WtE plant with return transport via transfer stations at the municipalities for filling of incoming waste to the sorting plant.

The press container station shall have position for sufficient numbers of containers. Numbers to be discussed. The station shall be operated automatically without need for manning during filling and changing of containers. Removal of filled containers and loading of empty containers will be by truck operator or internal transport.

For use of press containers at transfer stations without compressing unit, all containers should be possible to fill from top, in addition to use in the compressing station at the sorting plant. A total of 20 containers shall be included. Containers shall be sized for max net transport weight of waste from reloading stations to the sorting plant.

3.12.3 Alternative solution for storage and loading of outgoing waste

We will encourage the Contractor to, in addition to press container station, offer an alternative solution for intermediate storage and loading of waste to incineration. The alternative storage and loading should also enable filling of trucks with walking floor for longer transport distance (one way).

The solution shall prevent the spread of spill, dust, and odour. In addition, it must be robust regarding fire. Further, the solution shall be able to store outgoing waste from one day of production without any outgoing transport.

3.13 De-dusting system, incl. filter and chimney

3.13.1 General

A de-dusting system shall be designed to collect the dusty air from the main critical points of the process line, e.g.: chutes, connection between conveyors, separators, shredders, screens, and other equipment.

The de-dusting system will be placed outside the hall and can be designed in one large or several smaller source extraction lines with one stack as only one emission point.

The treatment of collected waste air is a bag filter. Bag filters should be provided to clean the outlet airflow from the main critical points of the process line.

The dust from the filters must be collected and transferred to a conveyor belt in the direction of the press container station.

The total amount of air resulting from the various extraction ports, the quality and technical details are to be given in the Offer from Contractor. A description of the dedusting units shall be presented in the offer.

The major system components are:

- Air extraction piping with manually adjustable flaps at the extraction ports
- Isolated and heated bag filter with dust extraction system
- Ventilators
- Stack with measuring platform

The final need of dedusting and measures related to smell will be addressed in detail engineering phase. The arrangement and design shall be prepared for installation of odor-reducing measures (e.g. activated coal, UV etc.). Such filter to be included as an option.

Regarding the air suction systems, if EX-protection measures are necessary, must be applied according to the ATEX rules. It will be mandatory to have spark detection systems and extinguishing systems in the pipes (e.g. before or after air-blowers, filters before intake). In Ex-zones certified technical systems must be installed between the decoupling exposed equipment.

For dust filters on EX-protection an automatic fire extinguishing system must be installed.

3.13.2 Ductwork

To control and adjust the flow rates, butterfly valves etc. are required.

In each branch line, near the extraction points, manually adjusting flaps must be fitted to control the exhaust stream in each area individually. The extractions ports and spigot connections must be equipped with a removable flexible connection to avoid vibrations in the piping system where it is needed.

The entire exhaust system is to be designed for a flow velocity of about 20-25 m/s.

Inspection and maintenance openings are to be fitted before or after the adjusting dampers, silencers, and ventilators, as well as changes in direction of the lines. In straight lines such openings shall be provided at recurring intervals.

Sensors, pressure gauges and flow measurements to the stack are to be installed with easy access at points of process control relevance.

3.13.3 Dust filter unit

Dust filter units for outdoor installation with clean air ventilators and silencers (for separating particulate matter from dust-laden exhaust air filtration system) shall consist of piping, filter unit and dust discharge system by a rotary valve system.

The filter system must be isolated and heated to avoid condensate in the bag filter housing and the dust transport unit into the sorting line.

The filter unit shall be designed as follows:

- with automatic regeneration through compressed air impulse de-dusting for continuous operation
- housing in stable circular construction incl. the supporting foot construction
- isolation and electrical heating system
- functions according to the down flow principle specifically for light dusts with low rate of descent
- hose mounting with optimal sealing by stainless steel snap ring, combined with internal clamp cuffs
- simple installation and removal of the filter elements on the clean gas side through optimal accessibility
- complete, top-quality filter configuration
- ladder with back protection, fully galvanised construction
- corrosion protection with high-quality coating system on sandblasted surface
- dust level sensor in the bottom of the filter housings
- safety switches at all access hatches to switch off fan and filter cleaning
- Automatic filter de-dusting in 3-piece ATEX construction
 - with digital setting of all control functions
 - differential pressure-dependent de-dusting with additional superimposed pressure independent period de-dusting
 - differential pressure display
 - automatic standstill post-clean, max. and min. alarm
 - and option to monitor the function of the valves with fault displays and fault memory
- Cell wheel lock EX
 - for unpressurised dust discharge
 - with external, dust-proof bearing incl. gear motor
 - Sealing strips made of rubber with fabric lining
 - Constructed complete with protective device for rotation monitoring

Dust emission behind the filter system is limited to $<3 \text{ mg} / \text{m}^3$.

3.13.4 Centrifugal ventilators

Using centrifugal ventilators, dust-laden air is collected in the source extraction. In the filter (suction side) the dust particles are removed and discharged through the exhaust chimney.

The ventilators must be centrifugal and of the same make.

The fans shall comply with the noise guidelines, acoustic enclosures are to be provided.

For the radial ventilators with belt drive, the wheel will have to be fitted with a speed monitoring device. For large ventilators, vibration monitoring is to be provided.

Air ducts to ventilators are to be built sound- and vibration proof by fitting expansion joints.

The base frame of the ventilator is to be set on anti-vibration dampers.

Operating characteristics and the efficiency curves of the ventilator have to be quoted with the tender.

3.13.5 Odor reduction filter (option)

A filter to reduce the odor concentration in the extracted air from process halls to be included as an option. The filter shall treat the after-dust filtration.

The filter shall be designed for outdoor installation and suitable for use during all seasons (summer-winter) and shall focus efficiency in combination with reliable operation, low pressure drop and long lifetime of reduction agent.

3.13.6 Stack

It comprises a steel chimney system, free-standing, self-supporting, concrete embedded items, with adapters, grounding, possibly ladders, lightning protection, safety lights if needed, terminals with internal coating, heated condensate drains and external coating. RAL color will be chosen by Client.

Platform including access for carrying out emission measurements has to be installed.

The stack shall have capacity to handle extracted air from process hall via dust filter (160 000 m³/h). In addition, the stack shall have connections for exhaust air from incoming storage hall (80 000 m³/h) and storage for sorted material (80 000 m³/h).

The specifications from the emission permit are currently not available, hence height is estimated. A stack with a height of 40 m and air volume flow of 320,000 m³/h shall be included in the offer.

3.14 Ventilation ductwork (air intake fresh air) in sorting hall

Client shall supply and install all ventilation ductwork in the sorting hall. This includes fresh heated air from the ventilation units with distributing pipes along the walls, downward pipes and air distributors.

3.15 Compressor plant

3.15.1 Compressor system

The scope of work includes a ready to-run compressor plant; a compressed air system for central air supply which also provides pressurized air for cleaning purposes, air-powered tools and on-site units.

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The dimensioning of the compressor plant has to be made so, that for summer operation mode and winter operation mode two different compressed air classes ISO 8573-1:2010 (partial/water/oil) for the pressure dew point are achievable:

- ISO, class [3:4:2] for summer mode with an outside temperature >5 °C
- ISO, class [3:2:2] for winter mode with an outside temperature <5 °C

The dimensioning of the compressor plant and the piping shall ensure that the use of pressurized air for cleaning purposes does not disturb the operation of the sorting equipment in the plant.

Compressors with integrated or separate refrigeration dryers and additional adsorption dryers for winter operation mode.

The units comprise, but not limited to:

- Rotary screw compressors including centrifugal separator before air dryer
- Water cooling system for the compressor plant with chiller outside at roof with all piping and needed equipment.
- Air treatment: Air conditioning/drying/filtration
- Condensate treatment: technology condensate treatment/oil-water separator oil/ water separator with discharge of treated wastewater on-site as a condensate floor drain
- Oil-bearing components need to be supplied with appropriate collection devices
- The buffer volume is sufficiently sized to minimize idle times of the compressors
- Piping within the system with bypasses for maintenance and 50 connection points for air-powered maintenance hand tools, including ball valves
- Safety equipment
- Dew point transmitter in main pipe to sorting plant
- Switch and control cabinet including cabling. Connection to central PLC
- The intake and exhaust system to cool the compressor room, with filter
- Each compressor with integrated heat exchanger oil/water
- Piping for heat exchanger in compressor room with all needed valves

The unit is partially redundant and shall have separate air-drying systems for winter time.

A detailed description of the offered products and components must be submitted, also quoting the relevant parameters.

The system must primarily produce a low specific energy consumption, have high availability and reliability. The corresponding parameters, in particular the specific performance requirements are to be submitted with the tender.

The compressor plant shall also provide the heating for the ventilation plant of the building Contractor with a heat exchanger in the compressor units to use the compressors as an additional heat source.

Delivery limit to the Building Contractor are the outgoing connecting flanges of the water pipe from the heat exchangers and the main valves at the wall. All piping in the compressor room is in Contractor's scope of supply.

3.15.2 Compressed air piping

The dimensioning of the piping system has to be suitable for the need of compressed air of the complete plant.

The piping system inside the compressor room has to be designed so, that each adsorption dryer or separate refrigeration dryer can be bypassed. By application of

ball valves, it must be possible to separate each unit for maintenance from the existing system.

Inside the plant, main ring lines for compressed air shall be installed in the process hall of the sorting plant. The main ring lines have to be separated in functional groups with ball valves. Continuous operation must still be possible, even if sub-areas are closed off. The number of bends shall be kept to a minimum.

Removable clamps shall be provided for attaching the air pipes to the steel beams. Generally, a vibration decoupling must be foreseen.

Unavoidable low points in the system shall be equipped with condensate drain. Two heated condensate alarm sensors shall be included.

The pipe material shall be galvanized steel, stainless steel, copper and/or aluminium (not plastic).

Safety quick couplings with ball valves are to be provided for the plant air system (process air).

3.15.3 Ventilation system compressor plant

The supply and exhaust system for the compressor unit room is designed ensuring temperature in the compressor room is $>5^{\circ}$ and $<40^{\circ}$ C.

If the temperature inside the compressor room exceeds an adjustable temperature threshold, the warm air must be brought out with a wall-mounted fan with filter for fresh air intake and a shutter flap for the outgoing air into the sorting hall.

Fresh air intake into compressor room needs a filter unit with EN 779:2012 class G3.

The compressor room must be held in over pressure all the time.

3.16 Process integrated fire detection- and extinguishing system

Even with a strong focus on ensuring that WEEE not are included in the residual waste, an increase in the number of lithium batteries in the incoming waste will have to be expected. To avoid this creating operational challenges and, in the worst case, destructive fires, the necessary detection and extinguishing system must be included in the process plant. This includes as a minimum the shredder and the baler.

The system shall detect and extinguish fires that occur in the material in the processing plant from the incoming feeding conveyor in the reception hall and until finished baled or loaded in containers in the outgoing storage hall. Detection and extinguishing shall take place with the least possible operational disruptions.

The system must log all incidents and shall have a connection to the building's fire alarm and extinguishing system. If a fire cannot be handled and extinguished locally, escalation must take place via signal to the overall fire system in the building.

The contractor shall describe and offer a required scope of such a process integrated fire detection- and extinguishing system.