Etelä-Karjalan Jätehuolto Oy

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ETELÄ-KARJALAN JÄTEHUOLTO OY DRY DIGESTION FACILITY AND BIOGAS UPGRADING AND FILLING STATION DESIGN AND TURNKEY-CONTRACT

GENERAL REQUIREMENTS FOR MACHINERY AND INSTALLATIONS

12.06.2018

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INTRODUCTION

This machine work specification includes general technical requirements for mechanical work at the construction site.

Deviation from these instructions must be noted in the tender. Deviations notified after signing the contract do not justify additional costs.

Accepting equipment

The machinery, apparatus and equipment specified in the contract must be manufactured according to Finnish legislation, regulations and official regulations. At the same time, they must be CE-approved and have CE-markings. Conformity certifications shall be kept in the facility's documentation.

Equipment structure and service life

During mechanical and piping works contractor shall pay attention to the conditions, temperature changes, long continuous operating hours, unmanned use, noise level, legislation, safety requirements, ease of maintenance and service, correct classification of machinery and engines, overload protection, gas, dust and dirt durability, etc. at the facility.

All installed equipment must be fully new.

In outdoor installations contractor must consider temperature changes and max/min operating temperatures as well as UV-light durability.

If needed/required, the contractor shall specify this for each machine and/or component by either providing relevant reference information from equivalent installations or applicable type tests and their conditions.

Equipment must be designed and installed so, that maintenance and replacing wearable parts is possible without dismantling and special arrangements. Except for wearable parts, all other parts must be designed for a minimum repair or replacement free service life of five years of continuous use according to instructions.

In case when replacing a component requires significant dismantling of the machinery, the service life of the relevant component must be at least ten years. Changing components can't be subject to structural modifications. The machinery's design life is at least 20 years. During this period no larger machinery or machinery assembly shall require replacement due to wear.

Used components and standard parts shall be selected/designed/manufactured according to generally accepted standards, with sufficient precision and must be interchangeable (without modifications).

Mechanical design shall account for protections against dust, dirt, moisture, gas, pests and malicious acts. Additionally, the structure can't create additional fire hazards or foster the progress of fire. Operating the machinery can't create stress that reduces the life of the structure.

Quality of work and general design level

Equipment shall be designed so that the shortest routine maintenance interval is no less than three months and six months for larger maintenance works that require plant shut-down. Deviations from these requirements shall be noted in the tender for each individual device. Bearings or other wearable parts must be easily repaired by mechanical fine tuning or be easily replaced during routine maintenance and without additional work stoppage that concern the whole plant operation. Should, in the purchaser's or purchaser's representative's opinion, an equipment component's wear exceeds the applicable or standard specified limits, which are agreed in the contract during the guarantee period, the contractor shall replace these at own cost even if the equipment is otherwise operating at a satisfactory manner. At the same time, the contractor shall implement measures to reduce future wear to acceptable levels.

Each device requiring spare parts shall be marked with a clear metal nameplate, showing the manufacturer's name, product code, serial number etc. basic information for identifying the machine for records and spare part orders.

Unless otherwise mentioned, equipment, their engines and gear boxes etc. (especially electric engines) shall be selected for continuous use at the facility's conditions.

Pipes, pipe connections and fixings, cables, cable shelves and bridges etc. are installed in an orderly and symmetrical manner so that they simplify maintenance and troubleshooting and are as easy to clean as possible.

Gauges and measuring equipment attached to pipes and control panels shall have the same visual appearance and be grouped similarly, so reading and observing is easy and user-friendly.

Cutting burrs and other sharp edges must always be removed by careful grinding. Equipment and installations shall be finished so, that the users are not exposed to excessive injuries or damages. No burrs or sharp edges are allowed on any railings.

Patents and protected designs

The contractor is liable for any possible patent use rights related to the equipment and processes and shall accept all responsibility for any possible patent or protected design infringement. The contractor shall reimburse the purchaser for any expenditure occurred due to re-building any equipment, that is necessary for the purchaser to use the process and/or equipment without patent or protected design infringements.

Storage and handling of equipment

Equipment included in the contractor's delivery and installation shall be stored according to the manufacturer's storage and handling instructions so, that they are not bent, damaged, corroded or otherwise harmed before actual installation and deployment. The purchaser may inspect the storage conditions and if they are found to be inappropriate, the purchaser may remove the deficiencies at the contractor's cost and responsibility.

Should it be necessary to store equipment outside before installation, they shall be appropriately protected from moisture and winter snow and supported on wooden frames so, that they do not touch the ground. All equipment and/or storage boxes shall be warehoused so, that they are easily found and available without excessive movement of equipment or boxes.

The contractor shall follow at least the following principles of storage:

- Equipment is not delivered to the construction site before approval by the purchaser's representative. This reduces the required volume of on-site storage. Equipment shall not be delivered before one (1) month from installation and/or deployment, unless the purchaser's representative gives written authorisation for earlier delivery.

- All equipment is stored ready greased, oiled, 'greased for storage' etc. unless otherwise is specified in the manufacturer's instructions.

- The contractor shall keep a binder with manufacturer's storage instructions at the construction site and make copies of the instructions permanently available.

- Should the storage period of equipment exceed initial plans for reasons not controlled by the contractor, the contractor shall obtain a certificate of operational state from the producer or agent. Related costs shall remain with either the contractor or purchaser, depending on who caused the delay. The certificate is also used by the manufacturer to determine possible guarantee changes.

- If any installed equipment or other component has, in the purchaser's representative's opinion, been damaged during storage, the contractor shall either repair or replace it at own cost.

- All rubber parts and components stored at the construction site shall be vacuum-wrapped and protected from UV-light. The same applies to any spare parts in the delivery or other components of organic origin that have a high cost basis and limited stability.

Installing equipment

The contractor shall be responsible for designed holes and equipment platforms as well as fixing bolts and end-fittings to the tolerances specified in this statement. The contractor shall also take care of filling any construction time holes, installation sockets etc. and the preparation of sub-foundations for equipment. If the above mentioned required holes, sockets, etc. must later be added to the structure, the relevant costs remain with the contractor.

Special care shall be paid during the installation of equipment and their alignment with installation sub-foundations. Before the foundation bolts are cast/tightened permanently, the equipment shall be aligned horizontally/vertically/sideways according to the manufacturers specified measurement tolerances.

The purchaser's representative shall inspect and approve the installation/alignment before fixing bolts can be finally tightened and locked where required. The contractor is responsible for the alignment and cost of equipment and connected pipes.

Additional instructions for installing, inspecting, deploying and accepting equipment are specified in RIL 148.

MARKING OF EQUIPMENT AND PIPES

Equipment rating plates and markings

All equipment and engines must be fitted with stainless steel and fire-proof material (preferably metal) type plates with the manufacturer's name, technical specifications, serial number, type marking, and year of manufacture engraved. The plates must be made in a way that ensures their readability over decades of use. Plates are attached either with corrosion proof screws or rivets. Use of glue is not permitted.

In addition to the above, all machinery, apparatus and equipment shall be marked/taged (named, numbered) with the purchaser's approved method by engraved, durable plastic identifiers, attached either by screws or rivets.

Machinery, apparatus and equipment identifiers (usually an alphanumeric combination, corresponding to the position number on the PI-diagram) must match the control buttons, electrical substation fuses and automation system's control chart. Same identifiers are also used on flow charts.

Identifiers/tags that require changing or renaming from the initial design or are added during design phase, shall be approved by the purchaser before engraving.

Pipe markings

Applicable standard
Finnish SFS 3701

STANDARDS, SYMBOLS, UNITS, TOLERANCES

Machinery standards

All machinery, pipes, valves, pipe supports, and connections shall conform to Finnish SFS standards or equivalent ISO recommendations if there is no Finnish standard. The contractor shall ensure, that all in-

stallations and equipment procurements conform to EU Directive 89/392 and have CE-markings. Corrosion protection painting is done according to the painting guidance and relevant SFS standards. Paint types and painting combinations shall be approved by the purchaser.

General provisions

The machinery, apparatus and equipment specified in the contract must be manufactured according to Finnish legislation, regulations and official regulations. Before deploying the machinery, the contractor shall obtain the relevant approvals for the machinery and installations from appropriate authorities. Related costs remain with the contractor.

Machinery installed outdoors must remain normally operational during the winter at temperatures up to - 30 C.

OCCUPATIONAL SAFETY

Machinery, apparatus and equipment must conform to the Occupational Safety and Health Act, regulations, government decrees and the technical safety regulations established by the Finnish National Board for Labour Protection. Electrical equipment must also conform to the regulations of the National Electrical Safety Board. They must at least conform to the requirements established in the following Finnish SFS handbooks:

SFS handbook 93–1, Safety of machinery. Part 1: General principles for design basics and risk assessment, 2005
SFS handbook 93-2, Safety of machinery. Part 2: Safety technique, safety distances, 2003
Safety of machinery. Part 3: Emissions control and measuring (noise, vibration, radiation, substance emissions)
Safety of machinery. Part 5: Passageways, 2006

Machines shall be built, arranged, installed and fixes so, that their use, maintenance, care and lubrication etc. is possible without accident or health hazards and working with the machine does not pose a risk of injury or illness to the user.

Equipment specific requirements

The baseline for selecting equipment must be safety as is and the lack of required additional protective equipment whenever possible. Pipes and electrical cables leading to technical equipment shall be placed either inside the floor, on walls or ceiling so, that passageways have a clear height of at least 2.4 m.

Whenever possible, all protective equipment shall be a fixed part of the machinery. If attached protective equipment must be used, it must be, if possible, connected to the equipment's functions so, that dangerous operations are only possible once the equipment is protected.

Hand wheels and levers must be dimensioned so, that the maximum required manual force is less than 200 N. Automatically functioning equipment shall be designed and built so, that employees can't be endangered during use or while being in the operating zone.

At least the following shall be encased:

- Rotating axle heads and connections
- Belt, chain and gear transmissions

Moving machinery (e.g. belt conveyors) shall be equipped with safety limiters that stop movement automatically if continuing might cause a hazardous situation.

Transporter engine's master switch must have an option to lock it in the open-position e.g. by a padlock. If possible, a 150 mm clearance shall be left between protective equipment and floors for cleaning purposes.

Warning and attention plates

Warning plates are yellow with black text, at least of A4 size, made from corrosion proof materials. Chemical equipment shall use standardised plates. Warning plates are attached, *inter alia*, to the following locations:

- Doors to any room with automatically starting equipment shall be fitted with a plate warning about automatically starting equipment.
- Transporters and equivalent equipment shall be fitted with a plate warning of rolling equipment.
- Chemical storage and chemical distribution room doors are fitted with chemical warning plates.
- The immediate vicinity of the chemical storage and the chemical distribution room is fitted with visible first aid instructions in case of chemical accidents and a face mask.
- Above every flushing valve on technical water pipes a warning plate shall be fitted with the warning 'Not drinking water'.
- Doors leading to rooms with cranes or lifts are fitted with plates warning of cranes or lifts. Lifting beams shall pass stress tests and permitted loads shall be marked on a plate.
- Rooms with explosive hazards and doors leading to such rooms are fitted with plates prohibiting smoking and fire.
- Tools that create sparks are prohibited from rooms with explosive hazards.
- Should the noise level of a working room or workshop exceed 85 dB(A), the doors or passageways leading to such areas are fitted with noise level warning plates and the requirement to use hearing protectors.
- If a railing is missing from any reason, a warning sign shall be fitted.
- Warning colour tones as specified in SFS-ISO 3864.

Attention plates are attached for example to the following locations:

- Fire hydrants and extinguishers.
- First aid measures.
- Emergency exits.
- A plate expressing the required protective equipment is fitted to entrance halls.
- Attention colour tones as specified in SFS-ISO 3864.

Safety colours

Applicable standard
SFS-ISO 3864

Passageways, working levels, stairs and ladders

Applicable Standards

SFS-EN ISO 14122-1:2016, SFS-EN ISO 14122-2:2016, SFS-EN ISO 14122-3:2016 and SFS-EN ISO 14122-4:2016

PREVENTION OF NOISE AND VIBRATION

Permissible noise limit values

Applicable Standards
SFS-ISO 1996–1, -2, -3; government decree 993/1992, government decree 994/1992, government decree 1404/1993, government decree 1314/1994 (Machinery Directive 89/392/EEC) with possible changes.

Prevention of vibration

Applicable Standards
ISO 2631, SFS-EN 1299 + A1, CEN reports CR1030–1, CR1030-2; government decree 1314/1994

CORROSION PREVENTION

Selection of materials for different corrosion categories

Applicable Standards
SFS-EN 10088–1,-2

Anti-corrosive painting

Applicable Standards
SFS 3314, SFS-EN ISO 10684, SFS 5873, SFS 8145, SFS ISO 8044, SFS-EN ISO 12944–1…8.

SCREWS, NUTS AND FIXINGS

Applicable Standards
SFS-EN ISO 4759–1, SFS 2197

QUALITY STANDARDS FOR WELDING

SFS handbook 54.

Applicable Standards
SFS-EN ISO 5817:en, ISO 17636

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AREAS WITH EXPLOSIVE ATMOSPHERES

ATEX Product directive (2014/34/EU)

ATEX conditions directive (1999/92/EC)

ATEX Act 1139/2016

Government regulation 1439/2016

SFS handbook no. 59

Electrical safety regulations. 1993. Electrical Inspectorate, publication A1-93

Electrical Safety Act (1135/2016)

Government regulation (1434/2016)

TUKES guideline 19/2017. Standards regarding electrical equipment safety and electrical work safety.

Applicable Standards
SFS-EN 60079-0, SFS-EN 60079-10, SFS-EN 60079-14, SFS-EN 60079-17

General requirements for areas with explosive atmospheres
Areas with explosive atmospheres shall be separated from adjacent areas. Passage is only permitted directly outside. Doors shall open outside.

Sufficiently effective ventilation shall be ensured in the premises. Permanently effective natural ventilation is preferred.

Equipment with dangerous surface temperatures shall not be placed in these rooms. Dangerous surface temperature means a temperature max 4/5 of the explosive mixtures ignition temperature.

Methane's ignition category T1 requires a maximum permitted surface temperature of 360 °C. The surface temperatures of heating equipment in the rooms are not allowed exceed 100 °C.

Spark creating tools or equipment is not permitted in these rooms.

Spaces and areas with explosive atmospheres, hazardous outdoor areas shall be fitted with easily noticeable and durable plates indicating the explosion hazard, smoking prohibition and fire handling prohibition. This requirement does not apply to inspection wells and lids.

Preventing static electricity shall be considered when selecting materials. This means that e.g. belt transmission must be avoided.

Equipment specified for these spaces must consider the requirements specified in § 41 of the Electrical Safety Regulations.

PUMPS AND PUMPING EQUIPMENT

Applicable Standards

ISO 3069 2000, SFS-ISO 21940-11:en, SFS-ISO 1940-2:en, ISO 11342; 1998

CHEMICAL EQUIPMENT

Regulations specified in the Occupational Safety and Health Act, official regulations regarding specific substances, Association of Finnish Cities and Chemistry Associations' guidelines and recommendations are considered when selecting, procuring, delivering and installing chemical equipment.

Dangerous goods containers shall be marked according to SFS 5491 standard.

Act on safety in connection with handling of dangerous chemicals and explosive products (390/2005).

ELECTRICAL DEVICES

General

The below requirements are applicable to devices delivered by the machinery contractor, their control etc. centres and related automated equipment. The contractor shall however verify the compatibility of all devices with the electricity and automation contractor's deliveries and agree on possible conflicts before delivery and installation of equipment. At the same time, the machinery contractor shall give notice of the actual electrical power and connection requirements of the delivered equipment.

Electrical devices and equipment must conform to the Electrical Safety Regulations and the SFS 6000 standard. All electrical equipment must meet the light industry standards for interference tolerance and emissions (EMC), as specified in SFS handbook 660.

The contractor is responsible for ensuring that all devices and equipment is suitable and reliable for the purpose of use and planned use conditions. The contractor is responsible for all official inspection and approval documentation and procedures.

All electrical equipment shall be approved by the client before ordering or starting manufacture. All equipment must have a CE-marking.

The facility's equipment shall be mainly controlled, monitored and configured by an automation system. Electrical equipment included on the contract (e.g. substations) shall be designed and constructed so, that automation functions and required connections are available.

Electrical equipment for spaces with explosive atmospheres are designed according to SFS handbook 130.

Protection levels of electrical and automation equipment

The protection levels of control centres, electrical engines, equipment and automation equipment shall correspond to IEC publication 529 or better:

Dry, warm and dust-free spaces (supervisory structure) IP 20.
Process space's internal, external and semi-heated spaces IP 65.
Spaces with flammable atmospheres IP 67.