

Employer
SAKO BRNO A.S.

Project
**High-efficient combined heat and power facility utilizing renewable sources (OHB
II - line K1)**

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PART III, APPENDIX A8

GENERAL TECHNICAL REQUIREMENTS FOR PROCESS



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1. AUTHORITY REQUIREMENTS

The Contract Object shall comply with Authority requirements, legislation in the Czech Republic, including acts, notifications, orders, instructions, circulars, regulations as well as publications, information and rules issued by ministries and agencies.

The Line shall be in compliance with all permits including environmental permit, the Directive 2010/75/EU of the European Parliament, the Council of 24th November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control) and the latest BREF guidance including Best Available Techniques (BAT) Reference Documents.

For parts specified in the Machinery Directive, such parts shall be CE-labelled and shall thus comply with all valid EU regulations. Requirements to health, safety and environment, including CE-marking, ATEX and functional safety etc. are further described in appendix A22 *Safety in design* and appendix B2 *Requirements to health, safety and environment*.

The Contractor shall comply with the provision of the Act. No. 22/1997 Coll. as amended and the applicable Government Decrees, with the emphasis on § 12 and § 13 of the Act No. 22/1997 Coll.

The Contractor must also have all relevant permissions in accordance with the law. Possible costs for such permissions shall be included in the Contract.

If any part of the Contract Object is not adequately covered by Legal regulation in the Czech Republic and the Contractor suggests compliance with a foreign law or notification, this shall be approved by the appropriate Czech authorities.

For Contract Object parts requiring Authority approval, the application for this shall be sent to the Employer for his comments before submitting the application to the Authorities. A copy of all correspondence with the Authorities, including appendices, shall be forwarded to the Employer for information.

If the Contractor intends to have a meeting with the Authorities, the Employer shall be informed no later than one week prior to the meeting being held and the Employer shall be allowed to participate.

The Contractor shall ensure that necessary permissions for release of the Line are inquired in such a time that erection and commissioning follow the milestones defined in the Programme according to the Contract.

2. GENERAL REQUIREMENTS

2.1 Standardisation of Components

When selecting components, standardised units shall to the extent possible be selected for the purpose of facilitating operation and maintenance as well as limiting the requirements for supply of spare parts. To accommodate this, the Contractor shall be willing to alter the Line in order to facilitate an overall standardisation of the various supplies. Such alterations of the Line for standardisation reasons shall not entitle the Contractor to additional payment.

The Contractor shall state reasons for non-compliance with standardisation before any purchase of such components. Otherwise the Employer is entitled to demand a replacement of purchased components to a standardised make or type.

Generally, the Employer will for each component group (valves, motors, actuators, instrumentation, equipment for control and monitoring system etc.) to the extent possible only accept one make for the Line.

The Contractor shall ensure that the standardisation requirements for components is followed by preparing lists of potential contractors for each component and shall coordinate purchases. These requirements also apply for subcontractors, where the brand of components is dictated by the Contractor.

The requirements for standardisation shall, however, not be given priority over and above the function of the Line, and it shall not be used as a reason for non-compliance with the stated guarantee, functional and environmental demands.

The components to be standardised include, but are not limited to: motors, pumps, drives, valves, cubicles, cables, instruments, frequency converters, gratings, hand rails and cable trays.

In addition, documentation shall be delivered in a standardised structure and form for all. Reference is made to Appendix A14.7 *Documentation*.

2.2 Redundancy

The Line shall be designed with a high degree of redundancy based on HAZOP and SIL assessments. The principle of double redundancy shall be employed in case failure of the component leads to risk of shut down of the Line, risks for health and safety or risk of increased detrimental environmental effects. In case of failure of one component, changeover to the second component shall be performed fully automatic. Excepted from these requirements are certain components, e.g. the primary air fan, secondary air fan, ID fan and burners.

Redundant components and systems shall be connected to separate electrical switchboards and separated CMS cabinets.

To ensure that the Line is based on a safe and reliable technical concept, the Contractor shall carry out a risk analysis exercise (incl. HAZOP and SIL). The Contractor shall issue separate documents with a thorough description of the risk analysis and the results from it including redundancy of vital components, connection to emergency power, fail safe valves, consequences of breakdown of main equipment (cooling water, pressurised air, power supply, CMS etc.).

Reference is made to appendix A22 Safety in design and appendix B2 *Requirements for Health, Safety and Environment*.

2.3 Energy Consumption and Recovery

The overall design of the Line shall be based on high energy recovery and low energy consumption, as well as an acceptable level of investment and future operational costs.

2.4 Environmentally Appropriate Design

This project shall be prepared so that the principles of environmentally appropriate design are followed.

Environmentally appropriate design means carrying out a project in such a way that any negative effect on people and nature from the Contract Object is minimised as far as possible. This shall apply to all phases of the project including:

- Design
- Manufacturing
- Erection
- Operation and maintenance
- Demolition and removal

In the selection of materials, products, processes and other activities concerning the entire lifetime of the Line, measures shall be taken to limit the impact on resources, health and the external environment. These measures shall be documented.

Such measures and considerations may consist of substitutions or limitations to the use of detrimental products or processes. The damaging effect can be estimated based on one or more of the below factors:

- Effect
- Amount
- Dispersal/spreading
- Accumulation

The Contractor shall describe the manner in which environmentally appropriate design is implemented and executed as part of the Contract Object and submit an action plan for this Work at latest six weeks after Contract signing. Included herein is the requirement of the Contractor to describe the extent to which new technologies will be used in the design.

3. OTHER TECHNICAL REQUIREMENTS

3.1 General

All components, which under a standstill can be exposed to freezing conditions, shall be protected by heat tracing and insulation. However, it may be assumed that the closed building will be frost free after the completion of the Line (except waste bunker and reception hall).

To the extent necessary, components and systems shall be provided with standstill heating to provide protection against corrosion.

For fluids, test sample bars (with drains and ventilation) shall be delivered.

Drains that commonly produce water shall be collected in drain boxes, or similar as deemed suitable by the Employer. Drainage piping shall be included to near the building gully and gullies shall be directed to the waste water tank. Condensate generated continuously under operation shall be reused in the condensate system.

Each drain pipe connected to a drain box shall be equipped with a local temperature measurement.

All drain outlets shall be provided with a shut off valve directly at the outlet (repair valve), a pneumatic operated shut off valve at the drain tank (to be used at start up), and a throttle valve at the flash tank (alternatively a nozzle to restrict the flow).

The drain valves and restrictions shall be arranged in such a way that they are easily accessible for inspection and maintenance.

Drains intended for emptying individual systems or components shall, in agreement with the Employer, be collected to a common pipe, which is fitted with a 1" thread, for fitting of a temperature resistant flexihose, which can lead the drain water to the nearest building gully. One flexihose for each room, including mounting arrangement on wall, shall be included by the Contractor of the main equipment in the room.

All valves to be operated in continuous operation and during start-up and shutdown shall be delivered with actuators and connected to the control system enabling operation from the control room under full control of the safety interlocking system. Only valves to be operated in connection with stops of more than 48 hours can be accepted without the possibility of control from the control room.

Actuated drain valves and steam traps shall be equipped with double shut-off valves for service reasons.

Location and number of measuring devices and nozzles shall ensure that the actual state of operation always can be determined with good accuracy, e.g. with regard to Performance tests, continuous operation and environmental measurements for inspection of environmental values, regular inspection and recording of performance, operating economy etc. of the Line.

It is of decisive importance that the measuring equipment shall be capable of precise operation - also in locations with a high level of dust and humidity. For the purposes of primary

measurements, flue gas/air flow measuring equipment shall be of the Venturi type. Where space or other conditions limit the possibilities, other types of measuring equipment may be proposed.

All necessary measuring points for manual measuring of combustion air and flue gasses for troubleshooting or design control shall be included in the Line.

The ducts shall be designed such that sufficiently long and straight measuring sections are obtained. The length of straight sections should be a minimum of five times the diameter before and twice the diameter after the measuring point.

Permanent measuring points shall be established in all air zones for continuous measurements of the amount of combustion air and cooling air.

Spherical tube ends shall be included for all boiler pressure parts of the boiler and the main steam pipes, except bottom headers on tube bundles in convection part.

Seamless pipes shall be used in the boiler/turbine and for district heating pipes up to DN450, unless otherwise agreed with the Employer.

The bearing housings of all fast running components which are grease lubricated shall be equipped with grease overflow discharge.

3.2 Painting & Colour Choice

The Contractor shall perform painting of machinery, piping, steel structures, galleries etc.

The Contractor shall as part Reviewable Project and Design Data package MD1 (refer to Appendix C1 *Reviewable Project and Design Data*) propose all colours for painting and for all visible parts, including all mechanical, plastic and fibre reinforced plastic parts. The colour proposal shall be based on the requirements in this Contract, industry best practice and the RAL colour code. The choice of all colouring is conditioned the Employer's written acceptance.

3.3 Conveying Systems

Conveying systems for ashes and consumables can be pneumatic as well as mechanical but must be fit for the purpose. A more detailed specification may apply for the specific system, cf. appendix A2 *Technical Specifications for Incinerator/Boiler* and A3 *Technical Specifications for Flue Gas Treatment System*.

Mechanical conveyors shall be of heavy-duty design and the system shall have references of successful operation under similar operating conditions. Torsion watch on the conveyors operating at the most severe conditions shall be installed as well as speed switch on each non-driven end. Alarms from this system shall be transferred to the CMS.

All conveyors (e.g. screw conveyors, belt conveyors etc.), rotary feeders and crushers shall be equipped with rotation guards in the opposite end of the drive, and with the possibility of full reversibility in case of e.g. clogging/blockage.

The driving shaft at each mechanical conveyor shall be equipped with a safety split pin which breaks if the conveyor is blocked to prevent further damages to the conveyor in case all other safety systems fail.

Inspection hatches must be placed at the end of every conveyor and where it is necessary for service and maintenance.

Pneumatic conveyors shall be of heavy-duty design and the system shall have references of successful operation under similar operating conditions.

Fluctuations in the compressed air consumption due to pneumatic conveying shall be handled by including adequately sized compressed air buffer tanks.

3.4 Plastic Materials

In case components or coating are offered in fibre-reinforced plastic (FRP), the design shall be in accordance with Appendix A14.11 *Fibre-Reinforced Plastic (FRP) and Plastic Welds*.

Thermoplastic polymers and polyolefins etc. like polypropylene are not accepted for high temperature medias.

Application of plastic materials shall be chosen with due consideration to the design lifetime, media, concentration, theoretic maximum temperature and pressure. All plastic pipes shall be adequately supported to ensure proper fixation and avoid bending.

3.5 Fittings, Pumps etc.

3.5.1 FITTINGS

All fittings necessary for operation, maintenance or required by the Authorities shall be included in the Line.

All valves, steam traps, strainers and similar equipment shall be of a well proven make. All fittings and valves shall be presented to the Employer for acceptance for each make and type. Medium and high-pressure valves, feed water valves, drain valves, etc. must be manufactured for welding in. Only in special cases may flange valves be used (for instance safety valves where dismantling for maintenance/testing might occur).

Ball valves or triple offset butterfly valves shall be used as shut-off valves in the district heating system, unless otherwise stated.

The inlet and outlet dimensions for fittings and valves shall be identical to the connecting pipes.

For pipes, hoses etc. which may have to be replaced or removed for maintenance during operation or standstill, shut off valves shall be installed. Special attendance shall be given towards the location of connection pieces and shut off valves.

All shut off valves for media with pressure >16 barg shall be established after the double block and bleed principle.

All valve housing shall have a higher resistance moment than the connected pipe systems so that tensions from heat expansion will not affect the lifetime of the valve.

Possible notch effects shall be taken into consideration.

At all fittings and valves the actual position of the valve must be easy to observe. Consequently, remote-controlled valves and all other valves which have no visible rising spindle shall be equipped with a position indicator.

All fittings and valves shall be leakage tested at the Contractor's premises in accordance with EN 12266-1 and DIN 1330-8, 1779 or corresponding standards in the Czech Republic.

Fittings and valves built together with pinions must have an EU approval in accordance with the Machinery Directive.

All valves \geq DN 200 shall be equipped with an actuator even if this does not appear from the concept diagrams (e.g. for service valves).

Dampers and valves with actuators shall also be possible to operate manually.

During shipment and storage all pipes and fittings shall be kept properly plugged at all ends. Pipes delivered with internal rubber coating or similar shall until the time of assembly have a cover plate bolted at both ends.

All pipe ends on installed piping and fittings shall be kept covered so that impurities do not penetrate into the pipes.

For exhaust pipes in the water and steam cycle, compensators shall not be used, except in special cases if agreed by the Employer.

The Contractor shall submit to the Employer a control valve sheet for all control valves describing the dimensioning, make and type as well as materials. The control characteristics and KV values of the valves shall be enclosed.

For assembly, inspection and documentation, all valid instructions shall be observed.

3.5.2 PUMPS AND FANS

For all pumps and fans the Contractor shall inform the following, as well as the specified tolerance of these parameters:

1. Make and type
2. Head
3. Flow
4. Power consumption
5. Pump curve/fan curve
6. Efficiency curves
7. NPSH (only applicable for pumps)
8. Materials

The values for the above parameters shall be stated for a minimum of 3 points on the pump curve/fan curve, e.g. in the normal operation point as well as the maximum and minimum operation points.

The Contractor shall present pump/fan characteristics and specifications used for dimensioning of the pumps/fan (head and quantity). Pumps/fans working in parallel shall have suitable

characteristics in order to obtain a stable pump operation. For RPM-controllable pumps/fans, curves for minimum RPM, 50%, 75%, 100% and max. RPM shall be included.

The pumps/fans shall be protected against overload. Mechanical gland seal system shall be used for pumps. Magnetic coupled pumps may be used for transfer of chemically aggressive media. Shut-off valves of ball valve type shall be installed for all pumps for servicing. Filters shall be included before pumps where there is a risk of particles in the medias.

As a general rule all pumps shall be designed for start-up against closed valve on pressure side in order to limit start current. The contractor has the full responsibility to deviate from the general rule when/if the pump media and/or process condition indicate this, and the Contractor shall submit notification describing the background for the exemption.

There shall be installed pressure transmitters around all pumps.

The impeller shall be of a corrosion proof material.

The attached driving motor shall be designed to ensure that it is not over-loaded even if it is operated outside the normal design range.

3.6 Actuators

All actuators shall be fit for the functional purpose.

The Employer prefers pneumatic actuator solutions. If the Contractor choses other types of actuators (e.g. electrical) this shall be presented to and approved by the Employer.

3.7 Hoisting Equipment etc.

All lifting facilities, i.e. cranes, tackles, hoists including running beams and travelling trolleys necessary for the dismantling and maintenance of components within the Line shall be supplied, marked with Safe Working Load, assembled, tested and handed over in accordance with appropriate Czech standards.

The Contractor has the responsibility of ensuring that all components can be transported safely and easily within the Line. As a minimum, crane facilities, tackles, hoist arrangements etc. shall be established for all components with a dry weight of more than 25 kg. Components shall be arranged to facilitate either a vertical lift or a horizontal move.

All larger components, which may have to be taken out for service or maintenance such as primary air fan, secondary air fan, feed water pumps, etc. shall have the proper lifting facilities available by means of permanent monorails or similar arrangement. Descriptions of how to de-install larger components for service/maintenance purposes shall be provided. All movements of components by cranes and maintenance equipment travelling a distance greater than 10 m must be motorized. Running beams placed in inaccessible areas shall also have motorized hoisting equipment.

Reliance on temporary or common mobile lifting facility for maintenance work is generally not accepted.

For the avoidance of doubt the Line shall be designed in so far as reasonably possible so that regular inspections can be carried out safely and effectively without the need for dismantling of components.

3.8 Welding and Inspection of Welding Work

The welding and the welding inspection shall be in accordance with the specifications stated in Appendix A14.1 *Welding and Inspection of Pressurized Parts*.

The Contractor shall be responsible for the planning, control and execution of the welding and inspection work in order to obtain and document the necessary welding quality.

Instructions for welding and inspection of the welding work shall be presented to the Employer.

The Employer is entitled to carry out inspection and control of the welding work at his own account by use of a suitably authorised institute.

3.9 Corrosion Protection and Surface Treatment

The corrosion protection and surface treatment shall be in accordance with Appendix A14.2 *Steel/Constructions for Process* where applicable.

All external surfaces of parts and components shall be corrosion protected in accordance with a programme prepared by the Contractor and approved by the Employer. The programme shall include a description of the material specification for the surface treatment, inspection of completed work and documentation.

Painting of machinery, piping etc. shall be performed. Protection methods shall be applied according to valid standards including concrete and other materials used for storage or channelling of fluids and other media that can be erosive, corrosive or reactive. Reference shall be made to section 3.2 of this Appendix.

All surfaces which have to be insulated shall be treated in accordance with a programme specified by the Contractor and approved by the Employer.

If corrosion protection or surface treatment is not possible, the reason for this shall be described. Furthermore, the corrosion allowance applied, and the lifetime shall be documented.

As part of the Contract Object the Contractor shall include inspection of the corrosion protection and surface treatment by a competent and impartial company approved by the Employer. All inspection work must be documented.

The Employer will not accept electro-galvanic coated parts or components.

Parts and components normally supplied with finishing paint will be accepted only if it is documented that the supplied surface treatment fulfils the specified corrosion class.

The Employer is entitled to carry out inspection and control of the corrosion protection and surface treatment at its own cost or by use of an authorised institute.

3.10 Acoustic Noise and Vibration

The Line shall include the establishment of all necessary noise insulation for compliance with the requirements made in Appendix A14.3 *Acoustic Noise and Vibrations*.

The Line shall comply with the vibration requirements made in Appendix A14.3 *Acoustic Noise and Vibrations*.

3.11 Thermal Insulation

The Line shall include insulation with cladding of all components in order to minimise the heat transfer to the surroundings, avoid condensation and obtain frost protection.

For insulation and cladding the requirements made in Appendix A14.4 *Insulation and Cladding for Process* shall apply. All insulation materials and cladding plates shall be approved by the Employer.

3.12 Flow Meters

Flow measurements in the flue gas and air systems shall be executed in accordance with Appendix A14.5a *Measurement Connections, Flue Gas / Air System*.

The Line shall include flow meters for all flows where required to determine a sufficiently detailed energy balance, including but not limited to HP steam, feed water, HP water injection, condensing scrubber etc.

Flow measurements in the water/steam system shall be executed in accordance with Appendix A14.5b *Measurement Connections, Water / Steam System* and delivered with an explicit indication of the flow direction.

Flow meters for high pressure (high pressure steam and feed water) shall be welded in.

Type and make, measuring accuracy, operational reliability, maintenance requirements etc. shall be in accordance with appropriate standards and approved by the Employer.

Any additional equipment subject to Performance tests shall be included in the Contract Object.

3.13 Instrumentation

Requirements for instrumentation, e.g. installation of sensors and transmitters, are specified in Appendix A14.5a *Measurement Connections, Flue Gas / Air System*, A14.5b *Measurement Connections, Water / Steam System* and A14.6 *Instrumentation for Process*.

The Line shall include all local instrumentation necessary and required according to standards, including locally indicating thermometers, manometers, level indicators, etc. Furthermore, sampling points with a manometer valve shall be arranged so as to provide the possibility of connection of test instruments.

3.14 Sampling Points

For the design of sampling points the following general rules shall apply:

- The detailed design of sampling points shall be presented to the Employer. All pressure-connected parts shall be designed on the basis of the data applying to the pipes on which they are installed.
- Each sampling point shall be equipped with a welding socket adjusted for the insulation thickness and a primary shut-off valve.
- Furthermore, the specifications stated in Appendix A14.5b *Measurements Connections, Water / Steam System* and A14.6 *Instrumentation for Process* shall apply. Multiple sampling points must be arranged side-by-side.

3.15 Documentation

Documentation shall comply with the requirements in Appendix A14.7 *Documentation*.

3.16 Labelling

Labelling shall comply with the requirements in Appendix A14.8 *Identification and Labelling of Components*.

3.17 Pressure Vessels, Tanks and Piping

All pressure vessels, tanks and piping shall comply with the requirements in Appendix A14.9 *Pressure Vessels, Tanks and Piping*.

All venting of silos, tanks and vessels shall be to the outside, through the roof (not colliding with any service cranes or other equipment). Venting through the façade can in special cases be accepted if agreed by the Employer. In all cases, the Contractor shall ensure vent pipes cannot become blocked / obstructed at any time (e.g. filled with water).

It shall be possible to drain all silos, tanks and vessels, except in special cases if agreed by the Employer.

3.18 Load bearing Constructions, Platforms, Stairs etc.

Steel structures, platforms and stairs etc. shall be manufactured in accordance with the valid Czech standards and in accordance with Appendix A14.10 *Standard for Staircases and Galleries*.

All necessary connecting galleries between service galleries and stair towers, platforms etc. of the building or galleries shall be included in the Contract Object.

Grate types, design of railings, safety rails etc. shall be approved by the Employer.

All steel included in the steel structures for platforms, galleries and stairs shall be surface treated in accordance with Appendix A14.2 *Steel Constructions for Process*.

The Contractor shall agree to design all platforms and stairs as well as the necessary supporting principles in full co-operation with the Employer.

The static calculation shall be in accordance with relevant Czech standards. The norm basis shall be agreed with the Employer prior to the design.

3.19 Pressure Testing

As part of the Assembly the Contractor shall carry out all pressure tests and leakage tests.

The Contractor shall arrange for pressure tests and approval of all pressure tanks requiring pressure tests and/or approval by a notified body. Furthermore, the Contractor shall determine requirements for any and all additional Authorities (including but not limited to the Health and Safety Executive and other statutory notified bodies) acceptance procedures and obtain all approvals as necessary. Any costs connected with the above shall be included in the Contract Object.

Pressure tank records as well as the approval by the notified body shall be submitted to the Employer not later than one month prior to the functional testing.

Pressure and leakage tests shall be carried out in accordance with an agreed Programme and possibly in stages, in order to take into consideration adjacent equipment delivered by other contractors.

3.20 Cleaning, Chemical Cleaning and Steam Blowing

All components included in the Line shall be carefully cleaned prior to the assembly. If the components are purchased by the Contractor, he shall carefully observe the Subcontractor's instructions as regards to shipment, transportation, storage and assembly.

During the Assembly, the Contractor shall at all times make sure that pipe ends are covered by protecting caps as long as possible.

As part of commissioning, the boiler, steam, feed water and condensate pipes shall be chemically cleaned by flushing, degreasing, acid cleaning and passivation. Furthermore, steam blowing shall be carried out. The Contractor will be in charge of the overall planning in cooperation with the parties involved.

All temporary Work for cleaning and steam blowing, including the neutralisation and the safe disposal of all generated wastes, shall be included. The scope of Contract Object shall include but not be limited to temporary pumps, pipes, heated fittings, silencers and exhausts.

All consumables for chemical cleaning and steam blowing of steam pipes, inclusive of consumables such as make-up water, fuel for auxiliary burners, etc., shall be included in the Contract Object.

Before warm testing and steam blowing, the Contractor shall prepare the Line for this, including release of all blocked pipe supports and hangers.

Contractor shall include hose reels attached to suitable water sources to facilitate wash down operations of the Line by the facility Operations and Maintenance personnel. The Contractor shall provide a schematic showing full coverage, hose locations, and sources of wash down facilities for Employers approval. Wash down access shall reach all process areas in the Line including, but not limited to:

- Boiler equipment,
- Flue gas cleaning equipment,
- Bottom ash extraxctors and riddlings conveyors,

- IBA conveyors (every 10 meters),
- Waste water tanks,
- Silos and storage tanks