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|  | Technical specification |
| **Title:** | **Grinding sludge treatment in SKF S. A. – Poznan plant** |  | **Factory:** |  **SKF Polska S.A** |
| **Project ID:** |  |  | **Channel:**  |  |
| **Tech. Spec. ID:** | DTT/2022/002 |  | **Leader:** | Maciej Migowski |
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1. **General Requirements**

Below here follows a general description of project implementation and scope.

* 1. **Intended Application**

This inquiry relates to briquetting systems for grinding sludge treatment in grinding area in bearing industry:

* Grinding machines for bearing rings – in coolant filtration system B-41

Intend of this application is to compact the grinding sludge in a briquette state, get rid of moisture to return to coolant loop and sell briquettes to external companies for rework (recovery of grinding sludge components).

* 1. **Scope of Supply**

The delivery includes design, planning, delivery, assembly, installation of a new briquetting system for sludge treatment, including all necessary conveyors (sludge and briquettes to the bin) piping and electrical, control and monitoring equipment, all commissioning and testing, technical documentation including necessary declarations of conformity, certificates whenever appropriate and labeling of a fully operational plant.

The delivery must consist of (as minimum):

* + 1. Grinding sludge conveyor from existing filtration system to the sludge buffer container (ready to collect and store sludge during filter regeneration cycle and enable continuous work of briquetting machine)
		2. Briquetting machine with all necessary equipment, including coolant container and pump to reverse to coolant loop
		3. Briquette conveyor to the bin
		4. All necessary building adaptation and changes of existing sludge flow. If necessary, the briquetting machine can stand outside the building B-41 in container. Such container must be then a matter of offer.
	1. **Project Implementation**
		1. **Time Schedule (Preliminary)**

The following time schedule applies for the project:

FAT implementation August 2023

Start of installation at SKF September 2023

Training of SKF staff September 2023

SAT implementation September 2023

Production start-up at SKF September 2023

* 1. **Machine Approval**

Approval of mechanical equipment generally takes place in two (2) stages:

1. On FAT (Factory Acceptance Test) implementation

2. On SAT (Site Acceptance Test) implementation

Each of these stages is then divided into two different activities:

- "machine inspection"

- "functional test"

FAT and SAT will be followed by signing **Acceptance Protocol – Appendix 1 and Appendix 2**

* + 1. **FAT**

FAT is carried out at the Supplier premises to see the working machine, confirm the principle, capacity and readiness for transport to SKF

* + 1. **SAT**

The SAT is carried out on site at SKF prior to handover of the equipment. Before handover can be made a SAT protocol must be signed by SKF to show that the

SAT has been approved. Test is performed for 1 working day and is then followed up concerning function and performance for at least a week.

* 1. **Availability**

The availability requirements that the machine/equipment must meet are to be found in Appendix 3 – **Availability**

* 1. **Training**

In the tender, the supplier must state all training that is necessary for handling of the equipment (operation, maintenance and service), to comprise as a minimum the categories specified below, and the costs for the items below are to be included in the tender submitted. Subsequent to an order, the supplier must, in consultation with SKF, create a time schedule for the training sessions in question, to include training, length of training, the number of sessions and a suitable number of participants. Notice should be given to SKF in good time of all training sessions, no later than one (1) month prior to such sessions. For the purposes of training, SKF must be provided the opportunity of being present during the final phase of machine completion. All the training material must be included in the documentation submitted.

* 1. **Warranty period**

For all delivered components and system, the warranty period shall be minimum 24 months from official takeover (positive SAT approval). For components with longer warranty period then written above, this warranty period shall be used.

1. **Machine Specification and Design**
	1. **Process Requirements and conditions in filtration system B-41**

Type of material: grinding sludge containing residues of

metal and grinding wheels particles

Sludge moisture content: 45% of coolant content in sludge

(coolant is a 6% water based emulsion

of coolant concentrate)

Sludge volume: 900 Mg / year (average 160 kg/h)

Filter Type: Belt with sludge cake

Briquettes moisture: max 2%

Electrical energy consumption: max 0,15 kWh / kg of sludge

Briquette bin location: ground floor outside the B-41 building

* + 1. **Available utilities in filtration room**
* Electrical power: 400/230 V 50 Hz, 5-wire-system
* Compressed air: SKF supplies with 5 bar in connection point, 3 deg. dew point.
	1. **Process Description**

Coolant is used for grinding machine operation. Dirty coolant contains grinding sludge residues including metal chips and grinding wheels particles. The coolant is delivered to filtration system which separate coolant fluid from sludge. It builds a cake on top of the filtration tissue. During regeneration process, the cake is delivered outside the filter, on belt conveyor. Now the sludge lands in the bin directly. In proposed solution, sludge after filters will land in storage bin on top of briquetting machine. Then, the machine will pull portion of sludge, press it to get rid of moisture and for a solid briquette. The moisture (coolant) will be pumped out to the central coolant system, while briquettes will be led into bin. The bin container will be taken by subcontractor and shipped to company for reuse. Part of the sludge must be reworked in recycle process.

* 1. **Machine/Equipment Specification – Mechanical**

This section contains a summary of HOW the machine's/equipment's mechanical systems should be designed.

Mechanical design and performance are to be the following SKF standard:

- Appendix 4: ***Std. 22-00 Standard for Mechanical Performance***

- Appendix 5: ***Std. 22-10 Standard for Pneumatic Equipment***

- Appendix 6: ***Std. 22-20 Standard for Hydraulic Equipment***

- Appendix 7: ***Std. 23-00 Standard for the Selection of Components***

and other standards citied below.

* + 1. **Machine Design**

Where possible, the use of compressed air as a power source should not occur and in cases where it is considered the only alternative the reasons for each individual case must be given. The choice of an alternative to compressed air should be made in full consultation with the SKF project manager.

* + 1. **Ease of Operation and Maintenance**

In general, equipment is to be designed so that it can be easily serviced and maintained. This involves suitable location of components, hoses, cables, etc. and good accessibility to the various parts of the equipment.

The machine/equipment is to be leak-free and there should be no drip pans.

All items on the machine/equipment are to be easily accessible in an ergonomically sound manner – this also to include those items that do not require regular inspection/service.

Additionally, the interior of tank should be easily accessible by service employees to clean up the swarf residues and provide other service in any case.

The machine/equipment should be easy to clean/tidy up, residual products are to be automatically conveyed away, and any sensitive equipment should be protected.

* + 1. **Pipe Marking**

All connecting pipes on the machine/equipment leading to instruments or appliances must carry an engraved sign at the connection and/or the valve. The pipelines must also be marked with flow direction and color which distinguish the fluid inside – see Appendix 8: **SKF 11H2021 121 Colors code Ed.04**.

* + 1. **Marking of Valves, Pressure Gauges, etc.**

This marking mainly concerns valves, gauges, etc. that are located within the machine/equipment itself.

Marking of valves, pressure gauges, lubrication points, tanks, vessels/reservoirs and inspection panels should be done according to Appendix 9: ***Std. 30-20 Standard for Marking Valves, Pressure Gauges, etc.***

* + 1. **Color Scheme**

The external surfaces of the machine (machine stand, electrical cabinet and other non-movable equipment) should be painted in RAL 7035.

Inside, the machine/equipment should be painted in white or a light color and the type of paint should be hard-wearing and resistant to the chemicals and environment in which it finds application.

Protective covers should be painted in the following color: RAL 5017 (BLUE).

Protective gratings are to be **black**.

* 1. **Machine/Equipment Specification – Electrical**

This section contains a summary of HOW the machine's/equipment's electrical systems are to be designed. Electrical design and performance must follow the SKF standards:

- Appendix 10: ***Std. 21-00 Standard for the Electrical Equipment of Machines***

- Appendix 7: ***Std. 23-00 Standard for the Selection of Components***and other standards cited below.

* + 1. **Electrical Design**

The electrical equipment should be designed so that individual subsystems can be de-energised (for service/maintenance) without operation of an adjoining system being affected. By "subsystem" is meant for example pumps.

All electric motors (<90 kW) must be of efficiency class Eff1. Any departures from this should be agreed in consultation with SKF.

* + 1. **Electrical Interface**

For all safety-related functions, the supplier must give a detailed description of how they are constructed, both internally within the mechanical equipment, and externally with regard to the adjoining system.

Transfer of information should in the first instance be via Profinet or Profibus. If Profibus is selected, the supply should include a DP/DP coupler for each connection assembled in the supplier's electrical cabinet.

* + 1. **Control System**

There should be the option of troubleshooting/upgrading software via modem or network.

All I/Os should be indicated on a separate display on the HMI panel.

Monitoring and controls of the filtration plant should be handled by a PLC based system, Siemens.

For remote monitoring purposes, the control system must be coupled with Ethernet unit.

Operational information and alarms/error signals shall also be indicated locally (on the front of the electrical cabinet).

Local alarm indication shall also include a flashlight lamp on the plant, but every alarm plain text shall be shown on the display on the electrical cabinet.

* + 1. **Operator Interface/HMI**

During the design/programming phase, basic data/examples of the screen display (including alarm management, indication, etc.) must be submitted to SKF for approval before a final decision on these is made. They should be accompanied by a supplementary description of the procedure for using the OP panel. All process values must be restricted to specified range of changes to avoid setting accidently improper number.

1. **Maintenance**
	1. **Maintenance System (CMMS) – API Pro**

SKF currently uses API Pro as its maintenance system. The data input must contain enough information to ensure that all parts that are repaired / maintained on the machine are also present in the plant record in the maintenance system.

* 1. **Preventive Maintenance instructions/Maintenance instructions**

Suppliers of machines to SKF must supply SKF with instructions for preventive maintenance for the machine in question. The instructions must specify enough preventive maintenance as to ensure that the machine is maintained in good order and have the availability agreed at the time of procurement.

The instructions must describe **how**, **when**, and **by whom** (level of expertise) maintenance is to be carried out.

The material must be submitted to SKF in a format that allows easy editing of text and illustrations.

The following information must be submitted for all **Machines**, **Systems** and **Components** that are part of any equipment supplied:

1. Preventive maintenance interval

2. Who is to perform the maintenance (level of expertise)

3. Machine state (In operation/Shut down) in which the work is to be carried out

4. Action - A heading for what has to be done

5. Description – Procedure for the action to be taken

6. Spare part required for the action to be taken

7. Nominal and limit values for warnings and alarms on inspections

8. Illustrations to make clear the location of the component on the machine

9. Down time required

Maintenance instructions shall be delivered to the customer in 3 copies, in A4 binders with tabbed index and shall also be sent digitally. Maintenance instructions shall be in Polish.

Maintenance instructions must be delivered at least 2 weeks prior to SAT.

* 1. **Maintenance – Preventive (PM) and Corrective (CM)**

All the equipment and information required for maintenance, testing, troubleshooting and repairs of mechanical equipment must be documented and reported in the form of, e.g. preventive maintenance instructions, drawings, etc.

Examples of the kind of information to be documented and reported are:

Any special tools needed; for example, tools for laser alignment and status control, and wiring/switches/software.

Specification of requirements relating to ladders, platforms, overhead cranes, etc., in order to be able to carry out maintenance safely.

A troubleshooting chart for operators and maintenance staff. There may be some variation in what such a chart looks like; for instance, a sequential diagram can be used for troubleshooting hydraulic systems.

*Service visits during warranty period*

During the warranty period the supplier shall perform service visits to the plant

without further costs. These shall include supervision, operation control and

preventive maintenance, including necessary supplies and spare parts, and if

necessary adjustment of functions, setting values, etc. in consultation with the costumers manager.

The number of service visits and the extent of these must conform to manufacturers' requirements and recommendations of the supplier. However, at least 2 visits should take place each year. The last visit should take place within one month before the end of the warranty period.

Written report from each service call with information about executed actions is to be transmitted to the customer within 2 weeks after the visit.

Client's operator is to be announced at least one week before each visit and should be given the opportunity to attend to the visits.

*Service at fault report*

During the warranty period the required service at fault report from the costumer shall be included. Last reporting time (from the supplier) at the service request is according to Orgalime, but no later than the next business day.

* 1. **Maintenance Costs**

For SKF to be able to assess costs for maintenance of the equipment, the following information must be submitted:

**Maintenance**:

Time required for carrying out preventive maintenance incl. of operational tasks/year (required man time/year for operation & maintenance)

The cost of consumables for PM/year

Spare parts costs/year

MTBF for critical components

* 1. **Operating Costs**

For SKF to be able to assess costs for operation of the equipment, the following information must be submitted:

**Operation**:

Consumption of air/hour of operation

Electricity consumption/hour of operation

Consumption of lubricants/hour of operation

1. **EHS – Environment, Health and Safety**
	1. **Energy Management**

SKF's operation must be run in a way that affords protection of the environment and savings in energy and natural resources. We have set environmental targets
as a central component of our work towards this. One of the factors determining SKF's ability to meet these Environmental Targets is that our suppliers also actively contribute to our work in this.

Energy efficiency of the system and its impact on total energy performance is one of the factors during evaluation process of potential solution.

* 1. **Noise**

See requirements of ***Std. 22-00 Standard for Mechanical Performance***.

* 1. **Machine Safety/CE Marking**
		1. **CE marked equipment**

For equipment that requires CE marking, or that is CE marked, in accordance with (2006/42/EG) all documents must be submitted to SKF's project manager with
a documented risk analysis before SAT testing commences. This means that the equipment must be CE marked before SAT testing commences.

All documents must be written in Polish, this also to apply for PLC programs with accompanying notes, and submitted to SKF's project manager before SAT testing commences.

Regarding the requirement for Polish for PLC programs with accompanying notes, English can also be accepted, after special agreement.

1. **Documentation**
	1. **TECHNICAL DOCUMENTATION etc. for installations**

The documentation shall include all equipment supplied, the entire plant, including any supplied equipment.

The documentation must be in Polish. Translated document shall also be supplied in the original language.

All the installation descriptions, labels and diagrams must be in Polish as well.

A document list of the entire documentation is to be delivered.

The documentation shall also be sent digitally.

3 paper copies are required and should be delivered at least 2 weeks before SAT.

* + 1. **Construction documents for the installation - process utilities**

The supplier shall supply the customer for review prior to manufacturing or installation begins:

1 Dimensional Drawings for units in the plant

2 Machine and equipment layout drawings

3 Flow chart

4 Document List, drawing list

* + 1. **Construction Documents for installations – electricity**

The supplier shall supply the customer for review prior to manufacturing or installation begins:

1 Drawings of boards, control cabinets and control panels

2 Power data for all load objects

3 Circuit diagrams. Unused connector features should be shown.

4 Internal and external connection diagrams

5 Apparatus list for all in the supply delivered actuators and control components, specifying the make, type and technical data.

6 Installation drawings for assemblies in cabinets, control panels etc.

7 Document List

* + 1. **Construction Documents for applications - control and monitoring**

The supplier shall supply the customer for review prior to manufacturing or installation begins:

1 Flow diagram showing the control components principled position

2 Functional descriptions

3 Circuit diagrams. Unused connector features should be shown.

4 Internal and external connection diagrams

5 Apparatus List for all in the supply delivered actuators and control components, specifying the make, type and technical data.

6 Installation Drawings for assemblies in cabinets, control panels etc.

7 Program that runs in PLCs

8 Document List

9 Configuration of parameters in any electronic devices as pre-set values

In addition, the provider will establish a basis for flow images, which shall be forwarded to the costumer. The costumer performs himself organization (drawing / programming) of flow images in the overall monitoring system.

* + 1. **As built documentation**

All the prepared construction documents and documentation of software, setting values, alarm limits, time delays, etc., shall be changed to as built documents, after completion of the plant.

All documents is labeled "as built documents", is dated and signed by the supplier's representative.

All documentation must be submitted both in binders and also digitally. Drawings are submitted in DWG format for AutoCAD 2000 or later.

Text documents are submitted in MS Word format. Some documents such as lists, etc. can be submitted in MS Excel format.

As built documents are delivered as originals to the purchaser at the latest at the notification for the SAT.

* + 1. **Operating Instructions**

Operating instructions must be delivered to the customer in 3 copies in A4 binders with tabbed index and shall also be sent digitally. Operating instructions shall be in Polish.

Operating instructions must be delivered at least 2 weeks prior to SAT.

* + 1. **Spare parts list**

Contractor shall include in documentation a complex list of spare parts together with name, type, supplier/producer, contact to supplier/producer, No of pieces installed, place of installation.

1. **Appendixs**

Appendix 1 – Acceptance Protocol

Appendix 2 – Checklist FAT & SAT

Appendix 3 – Technical Availability

Appendix 4 - Std. 22-00 Standard for Mechanical Performance

Appendix 5 - Std. 22-10 Standard for Pneumatic Equipment

Appendix 6 - Std. 22-20 Standard for Hydraulic Equipment

Appendix 7 - Std. 23-00 Standard for the Selection of Components

Appendix 8 - SKF 11H2021 121 Colors code Ed.04

Appendix 9 - Std. 30-20 Standard for Marking Valves, Pressure Gauges, etc.

Appendix 10 - Std. 21-00 Standard for the Electrical Equipment of Machines

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