



Badrakh Energy LLC
Zuuvch-Ovoo Uranium Project
H376512

Technical Specification
Mechanical Engineering
PM009 Vacuum Belt Filter

Technical Specification

PM009 Vacuum Belt Filter

H376512-PM009-240-242-0001

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Table of Contents

1. General	1
1.1 Scope.....	1
1.2 Deviations	1
1.3 Abbreviations	1
1.4 Definitions	1
1.5 Units of Measurement.....	1
1.6 Site Location and Conditions	2
1.7 Language and Documentation	2
1.8 Applicable Documents	2
2. Process Description	3
2.1 Overview	3
2.2 Belt Filter	3
2.3 Supporting Equipment	3
3. Scope of Supply.....	4
3.1 Vacuum Belt Filter Unit	4
3.2 Battery Limits	6
3.3 Installation and Support Materials	6
3.4 Nameplates.....	7
3.5 Work Excluded.....	7
4. Technical Requirements	7
5. Assembly, Testing and Packing.....	8
5.1 Shop Assembly and Testing	8
5.2 Preparation for Shipment.....	8
6. Quality Assurance	8
7. Performance Warranty	9
8. Construction Surveillance	9
9. Site Test.....	9
10. Start-up Commissioning.....	9



List of Table

Table 1-1: List of Abbreviations.....	1
Table 1-2: List of Definitions.....	1
Table 3-1: Package Equipment.....	4
Table 3-2: Battery Limits	6

List of Figure

Figure 1-1: Site Location	2
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1. General

1.1 Scope

- 1.1.1 This specification describes the scope and technical requirements for the design, manufacture, supply, testing along with installation, supervision and commissioning assistance of the Vacuum Belt Filter Package. The Vacuum Belt Filter shall be completed with all components and auxiliary equipment, including all minor items not specifically referred to, that are essential for the safe and satisfactory installation, testing, commissioning, operation, and maintenance of the equipment.
- 1.1.2 The Vacuum Belt Filter will be required to operate in the Area 0460, for the Zuuvch-Ovoo Uranium Project, located in the Dornogobi province of Mongolia. The Zuuvch-Ovoo Uranium Project is a planned facility to extract uranium using the in-situ recovery methods, process it on site, and produce Uranium Oxide Concentrate (UOC) for export.

1.2 Deviations

- 1.2.1 Any deviation to this specification shall be listed during the RFQ stage for consideration and approval by the Project.

1.3 Abbreviations

The following definitions are used in this document:

Table 1-1: List of Abbreviations

Term	Description
PFD	Process Flow Diagram
P&ID	Piping and Instrumentation Diagram
RFQ	Request for Quote
P&ID	Piping and Instrumentation Diagram
PCS	Process Control System

1.4 Definitions

The following definitions are used throughout this document:

Table 1-2: List of Definitions

Term	Description
Client	Badrakh Energy LLC, its authorised representatives and respective affiliates
Client's Representative	Individual or entity authorised to act on behalf of a client
Vendor/Tenderer	Individual or company that submits a proposal or bid in response to an RFQ, aiming to supply goods or services to a client

1.5 Units of Measurement

- 1.5.1 The International System of Units (SI) will be applicable to this project and shall be used, with some exceptions for the piping diameter and standard sizes for construction materials.

1.6 Site Location and Conditions

- 1.6.1 The Zuuvch-Ovoo operation is located in the Dornogobi province in the southeast Mongolia, around 500 km from the capital city of Ulaanbaatar. The mining site is south of Sainshand, which is the nearest city. The project location is shown in Figure 1-1.



Figure 1-1: Site Location

- 1.6.2 Equipment shall be capable of continuous operation in all respects for the site, location, area classification, temperature, atmospheric, climatic, altitude and all other conditions described in the applicable project site climatic conditions, the equipment specifications and any project specific requirements.

- 1.6.3 The site is characterised by its significant temperature extremes, refer to Site Climate Conditions Specification (H376512-8000-200-242-0001).

- 1.6.4 The equipment will be operated indoors under a temperature regulated environment.

1.7 Language and Documentation

- 1.7.1 The primary language for all information, data and documentation during the engineering phase of the project will be English.

- 1.7.2 All safety signage and labels shall be bilingual, including both Mongolian and English translations.

- 1.7.3 Final design drawings shall be in English.

1.8 Applicable Documents

- 1.8.1 All work contained within this specification shall comply with the Codes, Standards and Regulations applicable in Mongolia, the requirements of which are listed in the Package Document List (H376512-PM009-240-026-0001).

- 1.8.2 Where contradictions arise in codes and standards listed in Package Document List, the following order of precedence shall take place:

- Mongolian Codes, Standards and Legislation

- International Codes and Standards
- Project specifications or datasheets
- Relevant standards from other countries with approval from the Client's Representative.

1.8.3 All machinery, interchangeable equipment, safety components, lifting accessories, and partly completed machinery must comply with the essential health and safety requirements set out in the Machinery Directive 2006/42/EC or an approved equivalent local regulation.

2. Process Description

2.1 Overview

2.1.1 The vacuum belt filter package (PM009) receives an ammonium diuranate precipitate slurry and separates the ammonium diuranate precipitate particles from a mother liquor to produce a washed filter cake.

2.1.2 The slurry is fed to the filter across the width of the filter cloth, dewatered and washed with a two stage wash.

2.2 Belt Filter

2.2.1 The product feed, an ammonium diuranate precipitate slurry is continuously fed onto the moving belt of the vacuum belt filter package from Area 0440.

2.2.2 As the filter cloth moves over a vacuum chamber, the vacuum draws the filtrate liquid through the cloth, leaving a precipitate cake on the surface of the belt.

2.2.3 To remove ammonium sulphate and chlorine bearing dissolved salts, the precipitate slurry is then washed with demineralised water on the under-vacuum area of the filter cloth of the vacuum belt filter. This is typically managed by spraying wash liquid over the cake as it moves along the belt.

2.2.4 After washing, the cake is further dried by continuing to apply vacuum pressure, which removes additional moisture. Depending on the moisture requirements, mechanical pressing or air-blowing can be used to enhance the dryness of the cake.

2.2.5 At the discharge end of the vacuum belt filter, the de-watered and washed cake is scraped from the filter belt and falls by gravity through a chute to a screw conveyor.

2.2.6 The Belt is sprayed clean after the cake is discharged.

2.3 Supporting Equipment

2.3.1 The filtrates are drained through the filter cloth to the filtrate receiver by the vacuum pump's air suction.

2.3.2 The effluents from washing the cloth and belt are collected by gravity in the wash effluents tank.

- 2.3.3 The initial filtrate, or mother liquor, is collected in a first filtrate separator and then transferred to a first filtrate tank at the end of the barometric leg. The first filtrate tank shall be agitated to avoid accumulation of any precipitate slurry that has passed through the filter. The mother liquor is then recycled back into the process by the filtrate pump.
- 2.3.4 The secondary filtrate is also collected in the first filtrate separator and then transferred to a first filtrate tank at the end of the barometric leg.
- 2.3.5 The tertiary filtrate effluents is collected in the wash effluents separator and then into the wash effluents tank at the bottom of the barometric leg. This effluent is recycled by the wash effluent pump for a counter-current wash of the cake (first wash of the cake).
- 2.3.6 Air from the first filtrate and washing effluent separators passes through a cyclone separator for removal of any remaining liquid mist and separated air is then pumped by a vacuum pump to exhaust. Collected liquor from cyclone separator is sent to first filtrate tank.
- 2.3.7 The vacuum pumps shall be a water ring vacuum pump. The air pumped by the vacuum pump will be released to atmosphere, after being separated from the ring water in a separator. The water will gravity drain to the wash effluents tank or the area sump.

3. Scope of Supply

3.1 Vacuum Belt Filter Unit

- 3.1.1 The complete scope of supply shall include the engineering, detailed design, supply, workshop fabrication, assembly, training and testing of the Vacuum Belt Filter Package.
- 3.1.2 The Vacuum Belt Filter shall be supplied complete, including piping, mechanical equipment, instrumentation and controls, cabling within the battery limits, structural steel and supports, and all components and ancillary equipment, including all minor items not specifically referred to, but essential for the safe and satisfactory installation, testing, commissioning, operation and maintenance of the equipment.
- 3.1.3 The package shall include the following equipment shown in Table 3-1.

Table 3-1: Package Equipment

Tag	Description
0460-FIL-1000	Yellowcake Belt Filter
0460-CHU-1010	Yellowcake Discharge Chute
0460-CYH-1200	First Filtrate Cyclone
0460-SEP-1300	First Filtrate Separator
0460-SEP-1400	Washing Effluent Separator
0460-SCV-1700	Wet Yellowcake Screw Conveyor
0460-PMP-1100A/B	Vacuum pump (Duty/Standby)
0460-PMP-1510A/B	Washing Effluent Pump (Duty/Standby)
0460-PMP-1610A/B	First Filtrate Pump (Duty/Standby)
0460-TNK-1600	First Filtrate Tank

Tag	Description
0460-TNK-1500	Washing Effluent Tank
0460-AGI-1601	First Filtrate Tank Agitator
0460-AGI-1501	Washing Effluent Tank Agitator
0460-HOD-1000	Belt Filter Hood

- 3.1.4 The Vendor's scope shall include the process design and sizing of the equipment listed in Table 3-1 and any associated ancillary equipment included in Scope of Work. This must be based on the process inlet and outlet conditions and criteria specified in the datasheet (H376512-PM009-240-206-0001).
- 3.1.5 The Vendor's scope shall include the piping sizing including calculation of pressure drops and pipes nominal diameters.
- 3.1.6 The Vendor's scope shall include all mechanical items required for the equipment listed in Table 3-1 to be fully functional including, but not limited to:
- Belt filter frame
 - Transport belt and all rollers including head and tail pulleys, drive and gearbox for main roller, and all rollers
 - Belt carrying system, including belt curbing and lowering device
 - Fume hood
 - Filter cloth, including cloth guide/tracking and cleaning (for example: cloth wash spray) system with water supplied by others at the flowrate and pressure specified by the supplier
 - Feed mechanism, including feed distribution launder
 - Cake wash system
 - Wash launders
 - Full enclosure of belt filter with doors to reduce risk of final product contamination
 - Vacuum pump/s, associated ducting, vacuum seal strip system for filter
 - A once through seal water system used with cooled seal water supplied by others
 - Filtrate receivers, filtrate pumps for each stage and all interconnecting piping
 - Cake thickness monitor
 - Cake discharge chute
 - Moisture trap
 - Left and right-side rope switches (lanyard or pull wire switches)
 - Belt tracking switches
 - Cloth tracking switches along with auto adjustment device
 - Wet Yellowcake Screw Conveyor.

3.2 Battery Limits

3.2.1 The battery limits (up to and including) for the scope of work shall be as per Table 3-2.

Table 3-2: Battery Limits

Service	Description
Process Inputs	- Flanged connection to yellowcake feed pulp consisting of following streams/lines: - Thickener underflow from uranium thickener underflow transfer pump 0440-PMP-2020A/B (Intermittent Flow) - Yellowcake pulp from repulp transfer pump 0440-PMP-1070 A/B (Intermittent Flow) - Yellowcake pulp from fluidized bed precipitation reactor 0440-CFB-1000 (Primary flow) - Demineralized Water for cake wash/cloth wash/vacuum pump
Process Outputs	- Flanged connection of the following: - First Filtrate Pump Discharge - Wet yellowcake screw conveyor discharge - Belt Filter hood vent discharge - Vacuum pump vent/discharge - Waste water from water ring vacuum pump discharge
Utilities	Inlet connection for compressed air and demineralized water
Instrumentation and Control	Connections on field mounted instruments; terminals on instrument control panel and terminal JB of the equipment
Motor and Drives	The incoming/outgoing power supply terminals, as well as at the instrumentation terminals
Base Plates and Mounting	Including the mounting hardware necessary to secure belt filter and associated equipment
Earthing system	At earth link boxes/lugs/bars suitable for connection to the process plant earth grid

3.2.2 All battery limits shall be identified on the Vendor's PFD/P&ID.

3.2.3 All piping battery limits shall be equipped with ASME B16.5 flanges according to the Piping Material Classes Index (H376512-8000-250-216-0005) with supports located close to the external connection point.

3.3 Installation and Support Materials

3.3.1 The Vendor shall provide for the package:

- Detailed installation guides
- Operations manuals
- Maintenance schedules and procedures
- Static and dynamic loads to enable foundation and HD bolt design (By Others).

3.4 Nameplates

3.4.1 Unless otherwise specified or approved, each separate unit of equipment shall be fitted with a 316SS identification plate of minimum dimensions 100 mm x 75 mm x 2 mm thick, securely mounted using fixing screws, in a prominent position when the equipment is operating and neatly, clearly and indelibly engraved to display at least the following data in the order shown below:

- Equipment name and number as per the Vendor's equipment data sheet
- Project equipment number
- Pertinent manufacturer information (equipment tag no, make, model number, serial number, rating, etc.).

3.4.2 Engraved characters shall be upper case, vertical (not sloped), of 10 mm minimum height. The characters shall be inlaid with paint, after engraving, to provide visual contrast.

3.4.3 Plates shall be attached to the main frame of the equipment and not to any removable section (covers, doors, guards etc.).

3.5 Work Excluded

3.5.1 The Vendor's scope shall exclude the following:

- Design, supply and construction of concrete foundations and anchors
- All civil works, including grouting
- Field erection and installation
- Plant utilities, lighting, HVAC, receptacle power outlets, and fire alarm systems
- Transportation to site
- Receiving, unloading, and storage of the package at site.

4. Technical Requirements

4.1 All equipment shall be suitable for the duty defined in the referenced equipment application data sheet(s) forming part of the procurement package during RFQ stage.

4.2 Design life is 25 years. Equipment, including electronic devices shall be of the latest design which the manufacturer can support for the full design life after commissioning.

4.3 Equipment offered shall be of proven design, installed and operational at an existing location.

4.4 The equipment shall be designed for indoors installation. It will be in continuous operation 12 hours per day, 7-days per week, 52 weeks per year except for periodic plant shutdowns.

4.5 All separable portions of the mechanical equipment shall be equipped with lifting lugs/eyes etc. as the case may be.

4.6 Mechanical equipment shall be in accordance with the project Standard Mechanical Specification for Packaged Equipment.

- 4.7 Equipment shall be protected in accordance with the project Paint and Coating Specification.
- 4.8 Electrical Instrumentation and Components shall be of the type listed per “E&I Preferred Suppliers List” and comply with the “Electrical Requirement for Packaged Plants”.
- 4.9 Control System**
- 4.9.1 The Vacuum Belt Filter package is to be provided with a local instrument control panel capable of varying the vacuum pressure, belt speed, slurry feed, and discharge, as well as provision for starting and stopping of motors.
- 4.9.2 An operator interface with HMI and necessary control and safety devices is to be integrated into the local instrument control panel.
- 4.9.3 The control system shall have provision to interface with the plant control system for remote operation of equipment.

5. Assembly, Testing and Packing

5.1 Shop Assembly and Testing

- 5.1.1 Major components such as the drainage belt, vacuum pan, filtrate receivers, maintenance platforms, vacuum/seal/filtrate pumps and feed system shall be pre-assembled in sub-assemblies. Each sub-assembly shall be checked for alignment, fit, and function before proceeding to the next stage.
- 5.1.2 The sub-assemblies shall be integrated into the final assembly. All connections shall be secured and verified for integrity.
- 5.1.3 Electrical wiring and instrumentation shall be installed according to the electrical schematics. All connections shall be checked for continuity and proper insulation. Instruments shall be calibrated as per the manufacturer's specifications.
- 5.1.4 The full assembly shall be shop tested with representative performance test with the specified feed material (or substitute approved by Client's Representative) and operating conditions. All relevant data, including feed rate, water/air flow, temperature, drying time, energy consumption and moisture content of the output is to be recorded. Compare the results with the specified performance criteria.
- 5.1.5 After successful testing, the Belt Filter is to be assembled into modularised sections to the maximum practical extent, ready for shipping to Site.

5.2 Preparation for Shipment

- 5.2.1 Equipment shall be packaged and marked according to the requirements as specified in the Packaging and Storage Requirements(H376512-8000-200-242-0002).

6. Quality Assurance

- 6.1 Project quality requirements are captured in the referenced Quality Management System Requirements for Suppliers and Vendors Specification.

- 6.2 The Vendor shall permit access to their manufacturing, fabrication and assembly facilities, including those of sub-contractors and other suppliers for the purposes of inspection and testing.

7. Performance Warranty

- 7.1 The Vendor shall warrant the performance of the equipment to meet the duties specified in the Equipment Data Sheets (H376512-PM009-240-206-0001).

8. Construction Surveillance

- 8.1 The Supplier shall recommend a detailed construction sequence for assembly of Supplier's equipment and shall provide technical advice to assist with the development of detailed plans for site installation.
- 8.2 The Supplier shall provide suitably qualified personnel (on rates basis, when requested), to witness and provide surveillance during installation of the supplied equipment (excluding foundation construction). This shall include:
- Respond to site technical queries, through a formal technical query process
 - Verifying and signing-off that the supplied equipment have been installed as per the design documentation and in a manner that will not void the performance warranty.

9. Site Test

- 9.1 Site acceptance of the supplied equipment including sub-assemblies will be conducted by the construction contractor and witnessed by the Supplier (on rates basis, when requested) and Company.
- 9.2 The construction contractor will facilitate and document the site acceptance testing in accordance with the approved testing procedures agreed by the Supplier and the Company. Site acceptance testing will be conducted once all commissioning activities are complete and punch-list issues are resolved. Where applicable, acceptance testing documentation must list all forced variables in the PLC logic. PLC configurations must be transmitted to the Company at this time.

10. Start-up Commissioning

- 10.1 The Supplier shall provide a comprehensive staged commissioning program and provide suitably qualified and experienced personnel (on rates basis, when requested), to supervise commissioning.
- 10.2 The Supplier shall provide suitably qualified commissioning personnel to:
- Respond to site technical queries, through a formal technical query process
 - Supervise and provide assistance during execution of the Supplier developed commissioning plans/instructions by Company's personnel



- Verify and sign-off that the Supplier portion of the Package has been commissioned correctly and in a manner that will not void the performance warranty.
- 10.3 The Supplier shall prepare and submit a detailed Testing and Commissioning Plan for approval by the Company. The plan shall include cold and hot commissioning phases.