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Specification of Mechanical Transportation Design Criteria

Discipline: Mechanical Transportation

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EUROCHEM
MINERAL AND CHEMICAL COMPANY

Chemical Complex for Phosphates
 Processing Project


中国天辰
 中国化学 CHINA TIANCHEN

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1 GENERAL & PROJECT DESCRIPTION

As part of the implementation of a strategic investment project, “EuroChem” decided to build a Chemical Complex for the processing of phosphates in the Republic of Kazakhstan. The Project Site is located approx. 25 km west of Zhanatas. This chemical complex will comprise process units and utilities as defined in the following paragraphs, and includes a set of interconnected productions:

Number	Production unit
7G16	Sulfuric Acid Plant (SAP)
7G21	Potassium Sulfate Plant (SOP)
7G25	Di Calcium Phosphate Production Plant (DCP)
7G17	Calcium Chloride (CaCl ₂)
7G02	Offsite & Utilities (O&U)

2 ABBREVIATIONS

The list of abbreviations used in this document is provided in the below table:

List of Abbreviations

Abbreviation	Description
OWNER	EuroChem Karatau, Limited Liability Company
CNCEC	China National Chemical Engineering Group Corporation Ltd.
PRAYON	Process Design Package Licensor of DCP Plant
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BFW	Boiler Feed Water
CSC	Car Seal Close
CSO	Car Seal Open
EOR	End of Run
SOR	Start of Run
GA	General Arrangement
HMB	Heat and Mass Balance
IPDS	Instrument Process Datasheet
OSBL	Outside Battery Limit
ISBL	Inside Battery Limit
MSDS	Material Safety Datasheet
NPSHa	Net Positive Suction Head Available
TEMA	Tubular Exchanger Manufacturers Association
TL	Technology Licensor
TSV	Thermal Safety Valve
P&ID	Piping & Instrumentation Diagram

Abbreviation	Description
PDS	Process Datasheet
PFD	Process Flow Diagrams
PSV	Pressure Safety Valve
PVRV	Pressure Vacuum Relief Valve
SIL	Safety Integrity Level

3 INTRODUCTION

This specification covers minimum expectations for the design, materials, manufacturing and fabrication, inspection and testing of Mechanical Transportation Design. Project specific data will be detailed in the functional specification, drawings and data sheets.

4 DESIGN BASIS

- Relevant discipline requirement and information.
- Basic requirements for mechanical transportation design
- The name and properties of raw material and product
- The consumption of raw material and product
- The requirements of raw material and product
- The entering and unloading of raw material and product
- The period and capability of product and product
- The leaving and unloading of product and product
- Working shift system and working hours

5 DESIGN SCOPE

The main work scope of mechanical transportation includes solid materials (raw materials, semi-finished products, finished products) loading and unloading, transportation, storage, packaging and some processing process system design, and mechanical equipment selection design, such as belt conveyor, bucket elevator, crusher, screen, valves, packing machine, non-standard equipment and etc.

Note: Internal part in equipment package (for example, internal lube system and internal control system in complete sets of equipment) is the work scope of equipment vendor.

6 APPLICABLE CODES AND STANDARDS

- DTII (A) Type Belt Conveyor Design Manual
- Code for Design of Material Handling of Chemical Industry
- Safety and Hygiene Specifications for the Powder Engineering of Chemical Industry

- Code for Design of Storage Yard and Warehouse of Bulk Material of Chemical Industry

7 BASIC DESIGN CRITERIA

7.1 General

- 7.1.1 System design shall be based on the use of materials, sales channels, transportation and other factors, reasonable scheme selection, to ensure the reliability of the design scheme, practicability.
- 7.1.2 The mechanization and automation level of system shall meet the local and Owners requirements. The process design shall improve the operating conditions, to ensure the safety and health of workers. Meanwhile, the design shall save investment, and avoid blindly pursuing high automation.
- 7.1.3 The design capacity of the process shall be 1.2 times of the system capacity requirement. (For crusher and screen it shall be 1.25 times)
- 7.1.4 All mechanical equipment (except the auxiliary equipment, such as: unloading equipment, plow discharger, slide valve, iron separator, etc.) shall be set interlocking. Interlocking requires that when one equipment emergency cut-off, all the upstream equipment shall be stopped immediately, and all the downstream equipment shall be stop until all the materials are unloaded.
- 7.1.5 All equipment shall be equipped with on-site control boxes to set up internal fault Interlocks. The central control system only accepts the start, stop control and fault signals of the equipment.
- 7.1.6 All instruments shall be weatherproof and dust tight or shall be in a minimum IP65 or equivalent.
- 7.1.7 All motor protection shall be n a minimum IP55 or equivalent.
- 7.1.8 All transfer tower and product warehouse shall be 300mm above the outdoor floor. The net height of the warehouse shall not be less than 6m。
- 7.1.9 When more than two kinds of materials are stored in the storage yard, they shall be stacked in. The spacing of different areas should not be smaller than 2m.
- 7.1.10 When the trestle tilt Angle in 6~12°, the trestle should be set up anti-skid measures. When the trestle tilt angle above 12°, the trestle should be set treads.

7.2 Belt Conveyor

- 7.2.1 All conveyors shall be DT(II) A type.

- 7.2.2 Access to both sides of belt conveyor shall be provided in the head and pulley area for maintenance.
- 7.2.3 Walkway along conveyors shall be a minimum of 800mm wide.
- 7.2.4 Belts shall have a maximum slope of 18°.
- 7.2.5 All splices shall be vulcanized unless otherwise specified.
- 7.2.6 Normally, the belt conveyor should be driven by single motor, and the motor shall be located at the head pulley unless noted otherwise.
- 7.2.7 The belt speed shall not exceed 3.0m/s when using the middle unloading facility. The belt speed shall not exceed 2.5m/s when using the plow discharger.
- 7.2.8 When conveying the product bag, the belt speed shall not exceed 1.25m /s.
- 7.2.9 All belt conveyors shall uses troughing idlers with an angle of 35°.
- 7.2.10 Normally, convex vertical curve conveyors and concave vertical curve conveyors should use troughing idlers instead of bend pulley at convex and concave position unless noted otherwise.
- 7.2.11 All belt conveyors shall be equipped with training idlers.
- 7.2.12 Screw take-up used on conveyors less than 50m long. Gravity take-ups shall be provided on all conveyors over 50m long and on all conveyors with belt scales regardless of length. Minimum tension of the gravity take-ups shall be used for good conveyor operation.
- 7.2.13 All belt conveyors shall be equipped with belt cleaners. It shall be set at the bottom of the head pulley.
- 7.2.14 At loading points, belt conveyors shall be provided with steel plate skirtboards complete with rubber skirts. Skirtboards shall be set at least 4.5m, and provided with top cover plate unless noted otherwise.
- 7.2.15 To against belt damage caused by lateral movement or misalignment, limit switches shall be provided. Two sets of misalignment switches shall be provided. The first set will alarm and the second set will shut down and alarm.
- 7.2.16 A zero speed protection switch or sensor shall be provided on all conveyors to detect belt slippage or breakage from a slow-down in belt speed.
- 7.2.17 According to the process requirement a tramp metal detecting device and/or tramp collecting magnet shall be installed.
- 7.2.18 All conveyors shall have a continuous pull cord connected to limit switches spaced not more than 50m apart. Switches shall be two direction pull type with no dead end tie-downs. For conveyors with access on both sides of the conveyor a continuous pull cord to limit switches shall be provided on each side.

7.2.19 Protective guards shall be provided around drives, take-ups, tail pulleys, take-up carriages and rotating drive elements. All the guards shall be easy removal and service of guarded equipment. All guards shall be painted safety yellow unless noted otherwise.

7.3 Bucket Elevator

7.3.1 All bucket elevators shall be provided with gravity take-up.

7.3.2 All bucket elevators shall be provided with overhead lifting hook and sufficient head room for maintenance.

7.3.3 All chain bucket elevators should be provided with auxiliary motor for maintenance unless noted otherwise.

7.3.4 All bucket elevators shall be provided with a maintenance door at the bottom of the equipment for regular cleaning the bottom material accumulation.

7.4 Crusher

7.4.1 The equipment shall be manufacturer's standard size and heavy-duty design suitable for the conditions specified.

7.4.2 Crusher shall be furnished complete with all controls and instrumentation required to control and monitor the status or condition of the equipment. All systems requiring protection should be provided with sensory devices to initiate alarms and, when required, provide automatic shutdown of equipment.

7.4.3 Lubrication should be Vendors standard self-contained oil bath system.

7.5 Screen

7.5.1 The equipment shall be manufacturer's standard size and heavy-duty design suitable for the conditions specified.

7.5.2 The operating frequency of the screen shall be less than the natural frequency of the screen and its support system.

7.5.3 All systems requiring protection shall be provided with sensing devices and annunciators to signal remote alarm and, when required, provide for automatic shutdown of equipment.

7.6 Valves

7.6.1 Slide valves shall be designed such that there is no accumulation of material in the valve slide and no restriction of flow of product when the valve is completely open. The valve clearance shall be such that no jamming occurs in the valve slide ways.

7.6.2 Slide valve shall be knife gate type. Slide valves shall be suitable for operation from floors or respective rotary valves platforms.

7.6.3 All valves for solid material shall be operated by hand wheel or chain & hand wheel or by pneumatic cylinder or by electric. No internal lubrication shall be permitted in order to avoid contamination with material being handled.

7.6.4 Slide valves shall be heavy-duty type and suitable for closing against the flow of material and capable of withstanding total height of material column.

7.6.5 All slide valves shall be properly matched with upstream and downstream equipment to ensure that desired flow rate is achieved. Vendors shall guarantee the performance accordingly.

7.7 Packing and Product Warehouse

7.7.1 Potassium Chloride Storage Area

The raw material (potassium chloride) is delivered to the site of the Potassium Sulphate Plant by rail. The material is unloaded from the rail cars into hoppers, then potassium chloride is transported to the Indoor Raw Materials Storage Area by vibrating feeders and the belt conveyors. The material is loaded into the Storage Area using an unloading trolley and a telescopic unloader. Loaders are used to move the material to the Storage Area discharge funnels.

The supply of raw materials is organized from the basement of the Storage Area. The material enters the conveyor through the discharge funnels. Then, this raw material is supplied by conveyors to the Potassium Sulphate Plant.

7.7.2 SOP Storage Area

Potassium sulphate is transported to temporary storage silos. Then the product can be packed or bulked to the train.

Provide a covered storage area for the packaged product.

Provide engineering solutions for loading the big bag product into gondola cars

7.7.3 CaCl₂ Storage Area

Calcium chloride solid form shall be packaged and transported in a manner that protects the product from moisture and other sources of contamination.

Provide a covered storage area for the packaged product.

Provide engineering solutions for loading the big bag product into gondola cars.

7.7.4 DCP Storage Area

Product is transported to temporary storage silos. Then the product can be packed or bulked to the train.

Provide a covered storage area for the packaged product.

Provide engineering solutions for loading the packaged product into gondola cars and containers

7.7.5 Gypsum Storage Area

The gypsum is transported to the storage area by belt conveyor. The product is piled by a stacker in the Gypsum Temporary Storage Area. It is allowed to move the Storage Area within the master plan to optimize the location of facilities.

7.7.6 DCP CCP Mod Cake Storage Area

Wet magnesium cake from the CCP Module of the Dicalcium Phosphate Plant is supplied to the Indoor Storage Area by conveyor galleries. Then, it is transferred from the storage area by bucket loaders into trucks and transported outside the site.

7.7.7 DCP 1A Mod Cake Storage Area

The conveyor galleries supply the wet cake from the DCP Module 1A by a conveyor system to the Outdoor Storage Area. Then, it is transferred from the storage area by bucket loaders into trucks and transported outside the site..

7.8 Hoists

7.8.1 Service Hoists shall be motorized for lifts of over 5m; trolleys may be hand-operated for short runs or occasional usage. Monorail beams equipped with trolleys for use with portable hoists shall be supplied where suitable.

7.8.2 Provision shall be made for access to all hoists, with particular attention to maintenance and repair for the full range of travel.

7.9 Transfer Chutes, Hoppers and Bins

7.9.1 Steel chutes shall be connected to the hoppers and bins with bolts for installation which is necessary for field fitting and adjustment.

7.9.2 Material shall be mild steel plate of a minimum thickness of 6 mm unless otherwise specified. Connecting bolts shall not be less than 12mm diameter unless otherwise specified.

7.9.3 Chutes for limestone shall have liners. The minimum thickness of liners shall not be less than 4mm.

7.9.4 All bins or silos shall have level switches or level transmitters.

7.9.5 The valley angles of chutes and hoppers shall not be less than 50 degrees.

7.9.6 When the drop is greater than 1m, inclined chute shall be used at the end of the chute to prevent impact of materials on downstream equipment.

7.10 Bucket-wheel Stacker Reclaimer

7.10.1 The bucket wheel stacker and reclaimer is suitable for small sized bulk material, not for the large lump materials

7.10.2 The power supply of bucket wheel stacker and reclaimer shall be determined by the technical data provided by the Vendor. When flexible cables are used for power supply, the cables should be drawn from the middle of the yard. When the sliding contact line is used for power supply, the sliding contact line should be located in the ground groove. The groove should have a protective cover plate, and the drainage should be smooth in the groove.

7.10.3 The rail foundation of the bucket wheel stacker and reclaimer shall be 0.5m~2.0m higher than the yard floor.

7.10.4 A terminal limiter or an arrester shall be set at both ends of the rail of the bucket wheel stacker and reclaimer, and a locking device of the stacker and reclaimer shall be set at the same time.