

AL14 - Project Management of New Pot Feed and New Cranes Procurement at EGA Jebel Ali Potlines 5 and 6

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Abstract

EGA Jebel Ali Potline (PL) 5 and 6 are operated with 14 multi-purpose potroom cranes (MPPC). In addition, Jebel Ali PL 9 and Eagle section are operated with 2 MPPC of the same generation. The cranes are used for multiple operating functions, such as carrying out routine operations and supporting pot removal and startup. Those 16 cranes were installed between 1996 and 1999. They are approaching their end of life at 25 years of service between 2021 and 2024. Lean Team also conducted a study on PL 5 and 6 cranes utilisation, and it was found that the significant contribution to high utilisation and low availability (breakdown) comes from alumina filling operation. The alumina filling operation contributes 20 % to the increased utilisation.

A separate project was also initiated to install an independent Pot Feed System for PL 5 and PL 6. The benefit includes reducing crane utilisation, as the dependency on cranes for pot filling will be eliminated. Due to the Pot Feed system project implementation, the number of cranes will be reduced by two. Lean Team studies have validated this. Ageing cranes will inevitably increase maintenance and repair/replacement costs after their initial life extension, leading to uneconomic operation and impact on the hot metal operation. Refurbishment of the existing cranes was initially considered. Still, this option was dismissed in the feasibility stage, as any old re-certified and refurbished crane requires re-inspection every three years and may incur additional costs due to unpredictability compared to the advantages of purchasing new and technically better cranes. The new MPPC cranes will benefit from a 25-year new design life guarantee and will be equipped with a double braking system resulting in improved safety in liquid metal handling. The new MPPC cranes will have the built-in physical improvement to adapt to the D20+ technology in future without further investment. The cranes will be designed to work up to 275 kA according to the current amperage target.

The project installation of pot feed required working on live pot superstructures of 480 pots in an operational plant and courtyards. The existing construction crane was modified to maintain the insulation needed for the potroom area, and dedicated workforce was trained for crane operation. The overall system was subdivided into pieces based on process, and accordingly, more than 60 Method Statements and Risk Assessments were active for work completion. Similarly, the crane project required the assembly of the main girder, tools trolley and electrical components in a dedicated laydown. The significant risk identified during the project fabrication stage was the availability and procurement of Rockwell components. Also, it was essential that MPPC crane installation and dismantling should be done in a sequential manner to meet the 25-year deadline as per legal requirements.

Keywords: EGA Jebel Ali potlines 5 and 6, Multi-purpose potroom cranes (MPPC), D20+ technology, Method statements, Risk assessment.

1. Introduction - Project Definition

The requirement for a new dedicated Pot Feed System arose in 2017 when it was found that EGA Jebel Ali Potlines 5 and 6 (PL 5 and PL 6), crane utilisation was high. A Lean team study established this, which identified the need for additional multi-purpose potroom cranes (MPPC). The significant contribution to this high utilisation was the withdrawal of alumina from the fume treatment plant (FTP) silo and later feeding to individual cells (Figure 1). The continuous travelling of the crane across the potroom resulted in lots of wear and tear of equipment and maintenance costs. In addition, the alumina dust affected the environment and crane equipment, leading to more breakdowns. In addition, the PL 5 and PL 6 cranes had approached the 25-year design life cycle in 2021 and 2024, respectively. There was an opportunity to introduce the alumina conveying system-based Pot Feed System in those lines, which potentially reduces the workload on the cranes, their downtime, and can potentially extend the life of the existing cranes. It also brings further potential for reduced CAPEX in case that the cranes need to be either replaced or life extended through refurbishment in the future.



Figure 1. Left: crane usage to feed alumina to pots; Right: crane usage to feed alumina to pots.

The project was raised in 2017 by the operations management. Initially, in the definition phase, the budget estimate quotes were requested from various specialist suppliers to plan the high cost for the work involved.

Timeline – July 2017 to June 2018.

2. Pre-Feasibility Stage

During the prefeasibility phase of the project, the following work was done.

- Advanced end-of-life study and analysis of a typical MPPC from Potline 5 through the original equipment manufacturer (OEM),
- Front end studies for the implementation of the Pot Feed System to define the impacts from the interfaces of pot superstructure, FTPs, constructability with budgetary proposals received from various vendors, and the inherent technology of each proposal,
- Detailed capital expenditure plan with cash flow for a phased implementation of the system.

Timeline – Aug 2018 to July 2019.

3. Feasibility Stage

During the feasibility phase of the project, the following options were considered, which were later, shortlisted to the selected item (Table 1).

Table 1. Options for pot feed system and cranes.

Options	Other Option(s)	Other Option(s)	Selected Option(s)
Option title	Pot Feed System with 13 cranes refurbishment	Refurbishment of 14 cranes and procure two (2) new cranes	Pot Feed System with 12 new MPPC cranes of double anode extraction
Scope (brief description)	1) Installation of four individual Pot Feed System 2) Refurbish 13 no. of cranes	1) Installation of 2 new MPPCs (similar to existing design) 2) Refurbish 14 cranes	1) Installation of four individual Pot feed System 2) Install 12 new MPPCs of double anode extractor
Schedule	Approx. 4 years	Approx 4 years	Approx 4 years
Impact on productivity and EHS	<ul style="list-style-type: none"> Eliminates dependency of cranes for pot filling Sustain 264 kA operation and meet 5-year vision Reduce frequency of non-compliance to federal limits (25 %) 	<ul style="list-style-type: none"> Does not allow any major improvement/changes in the working conditions, high dependency on cranes shall remain on Pot filling and associated crane breakdowns cannot be eliminated. Compliance to federal limit on HF emission is not ensured 	<ul style="list-style-type: none"> Eliminates dependency of cranes for pot filling By introducing the Pot Feed System, will be able to improve the availability of the cranes, lower the utilisation and as well as reduce the incidents of Environmental non-compliance
Advantages & disadvantages	<ul style="list-style-type: none"> Pot Feed System will eliminate the dependency on cranes in Pot filling. Adding venting/dust to FTP fume duct (additional load on FTP). 	<ul style="list-style-type: none"> Cranes will continue to be used for pot filling. Not a long-term solution 	<ul style="list-style-type: none"> New cranes will have a design life of 25 years. All new cranes come with latest safety features (notable being the insulation monitoring system and double braking system in metal tapping

4. Execution Stage – Pot Feed System for PL5-6

The contract start date was 23 December 2021 for Pot Feed System. The new alumina Pot Feed System had to be designed to fulfil the CD20 pot requirements in PL5 and PL6, for the following (Table 2):

Table 2. Alumina pot feed system requirements for CD20 pots.

Potline / FTP	Sections	No of pots connected to each FTP
PL5 / FTP 5A North	1, 2, 7 and 8	120
PL5 / FTP 5B South	3, 4, 5 and 6	120
PL6 / FTP 6A North	1, 2, 7 and 8	120
PL6 / FTP 6B South	3, 4, 5 and 6	120

The scope is to design the alumina Pot Feed System, which will be based on continuous operation 24 hours per day, 365 days per year, with sufficient redundancy and adequate flexibility in the system's operation to meet the future capacity required for any amperage increase, emergency situations, etc.

The alumina distribution system to include suitable tapping from the existing secondary silo discharge/crane filling air slide, provision of rotary feeder for control feeding with necessary manual/ actuated valves and bypass line, vibrating screens, installation of a courtyard distribution air slide below the existing silo platform, distribution bins as needed, potroom air-slides with degassing pipe, secondary steel for mounting the distribution bin, blower air piping for fluidisation, connections and valves to convey alumina to both sides along the length of potrooms (Figure 2).

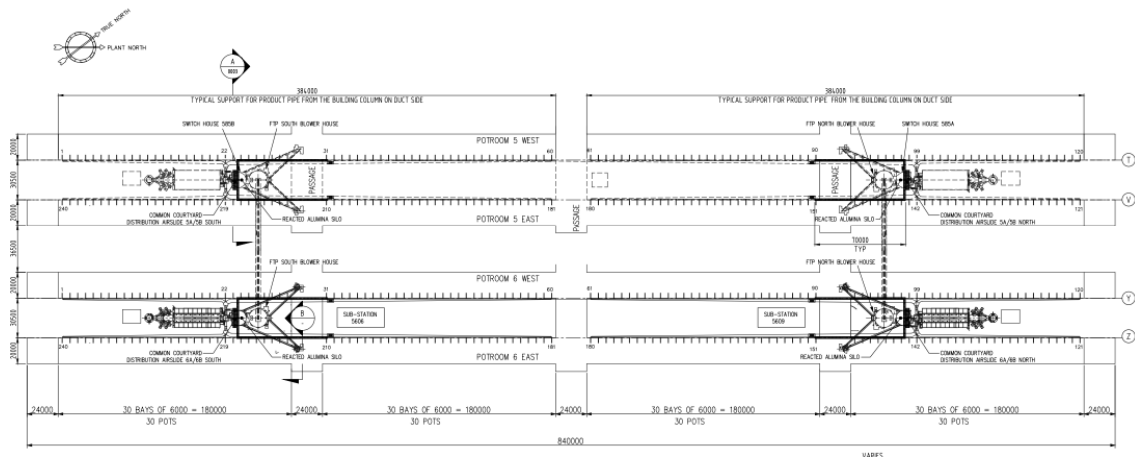


Figure 2. Pot feed system layout.

The reacted alumina is to be tapped from the existing silo ports and fed through rotary feeders into a screening station. The screened and acceptable alumina will then be discharged into the courtyard distribution air slide between the potrooms perpendicular to the potlines. The Pot Feed System will be fed by an air gravity conveyor that transports alumina gently from the secondary alumina silos through a metering device (rotary vane feeder), vibration screen and a horizontal air gravity conveyor to each pot storage bin. The courtyard distribution air slide feeds the alumina to either side of the potroom into potroom building air slides parallel to the building. The isolation facility (material and air) for each pot branch of alumina conveying air slide for each superstructure will be provided. Refer the process flow diagram in Figure 3 that summarises the process.

In the following sections critical tasks were identified to be carried out on time so that the next interdependent job should not be affected. Related constraints identified with critical activity are also described. In March, the design review and hazard and operability study (HAZOP) of the Pot Feed System were also completed to ensure that the design meets the plant safety standards.

4.1 Engineering

- Finalisation of critical engineering deliverables, such as general arrangement drawings, process flow and PID drawings, with detailed design for primary alumina, air slide systems and piping fabrication.
- Finalisation of structural calculation reports for air slides and cantilevered support, silo structure re-reinforcement and new walkways and platforms under the silo and any impact on the existing building structure.
- Finalisation of location of fluidising fans for all systems and electrical containers for potlines (PL) 5A and 5B.
- Finalisation of electrical design drawings, architecture, single line, and electrical / instrument location details. Due to the transformer limitation, the required electrical

system must be designed to comply with relevant standards. The electrical load should not exceed 200 KVA for each FTP and is considered in the design.

In between, the design activities for the piping design had to be rearranged and modified due to the relocation of fluidising fans to inner courtyards. The structural design was also impacted due to piping routing and relocation. Also, the civil design for foundations for fluidising fans and electrical containers was delayed due to the new location of fluidising fans. Overall, there was no impact on completion dates.

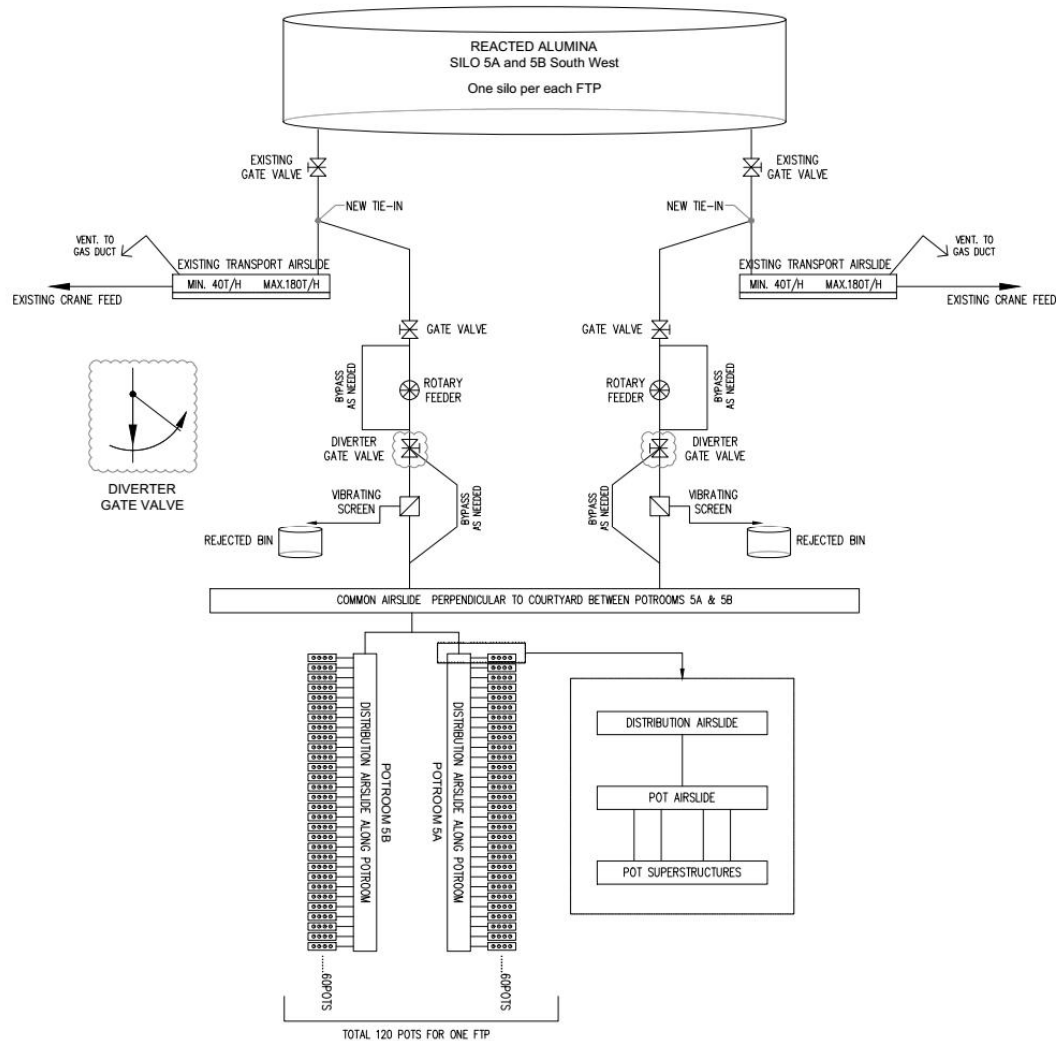


Figure 3. Process flow diagram.

4.2 Procurement and Manufacturing

- Negotiations and procurement for all significant packages, i.e., steel supply and installation, civil works, glass reinforced plastic (GRP) air slides, vibrating screens, fluidising fans, flexibles, electrical cabinets, control system cabinets, electrical installation, valves, instruments, fire detection of electrical cabinets, rotary motor feeder, fabric air slide, and for miscellaneous items (gaskets, bearings, etc.).

- Manufacturing of each critical item required for project had to be completed, i.e., for pot and distribution air slides, pot covers, walkways, and structures (end of air slides), fan manufacturing, rotary feeders, vibration screen fabrication for all the systems, flexible hose fabrication, Electrical and control delivery on time, final assembly of the panels, and electrical container fabrication.

Post-COVID, all major purchase orders were issued on time so that the approval of detailed design and start of fabrication was completed as planned.

4.3 Construction

Similarly, in the construction phase, it was necessary to commence each activity that depends on other activities on time.

- Commencement of steel deliveries (planned to start in mid-June 22).
- Installation of the ventilation system on pot superstructures in the pot repair building (started in early March 2022). Installing the 2" vent pipe (Figure 4) through the new hole cut by gas cutting was required and involved working on the superstructure sent to pot repair (Figure 4). It was considered a confined space entry. Hence appropriate ventilation was needed through suitable exhausts and blowers.



Figure 4. Left: vent pipe; Right: ventilation installation in the pot repair.

- Replacement of hopper covers.
- Installation of cantilevered supports bolted to pot room columns, including sealing.
- Installation of horizontal distribution air slides along potrooms in the courtyard. It required working in a dust-laden, magnetic field and hot environment. There was a risk of fall of person and materials from height. It had to be suitably controlled with appropriate training, limit exposure to dust, wear suitable respiratory protection and hand gloves, wearing the full body safety harness with double lanyard while working at a height.
- Installation of crossover/transport air slides (Figure 5).



Figure 5. Left: installation of crossover/transport air slides; Right: installation of crossover/transport air slides.

- Pot air slide installation in potrooms (Figure 6). Required preparation of lifting diagrams for installation work in the potrooms. For the installation of the air slide and the hopper cover, a temporary access platform and wooden trolley, with additional steps, were used. These steps were tied together with the temporary platform by lashing belts.



Figure 6. Pot air slide installation.

- Scaffolding in the silo area and installation of walkway and support steel structure under the silo.
- Civil work for foundations in potrooms 5A, 5B, 6A and 6B. The work involved checking the underground services, availability, and validity of documents such as excavation permits and no objection certificates (NOC), availability of mechanical electrical

plumbing (MEP) clearance, risk assessment, shoring and dewatering permits. Then slab breaking, hand excavation, road base backfilling, shuttering, rebar binding, concrete pouring and backfilling. It had to be done in the courtyards' hot, magnetic, dust-laden operational area.

- Installation of fluidising fan and piping in all four FTP areas. It involved lifting using the crane in a magnetic field area. It required only trained (molten metal/electrical hazards training) and competent employees to work in the location—all vehicles, cranes, lift platforms (JLG), hiab to be approved for operation in magnetic field. A minimum of 4-meter distance was required from moving equipment. All steel material must be adequately secured while transporting under a magnetic field. Existing plant structure and limited maneuvering space during the lifting activity had to be considered. Proper fatigue management had to be implemented and monitored during critical lifts. No employees were allowed to work at heights on any wet elevated work platform. Proper tag lines were used to control the swing load. All lifting operations were to be suspended if the wind reached 35 km/h.
- Construction crane modification, testing and verification, including insulation testing. Aligning the crane with the down shop conductors in PL 5 and PL 6. It included supplying and installing a new hoist limit switch as per EGA requirements. The lower limit switch will be set at 5 m from the floor.
- Management and transfer of construction crane (Figure 7) inside potroom by operations. It involved separate training by EGA for using the construction crane.



Figure 7. Lifting using the construction crane.

- The tie-in of the Pot Feed System had to be completed in a limited agreed shut-down time with operations (Figure 8). It required welding of pre-cut plates with stud bolts on the outlet box under the secondary silo on air slides for the tie-in pipe, cutting of holes in the outlet box using a grinding machine for fixing the tie-in pipe, bolting of the outlet pipe and knife gate valves, and thereafter installation of rotatory feeder and its support. All the access and temporary storage area had to be identified and agreed upon. The vehicle access route should be clear to transport materials. Lifting activities using a crane in day shift for lifting and positioning the outlet chutes rotatory feeder and supports. High wind impact on lifting operation leads to toppling over crane with load, hence tag lines to control the swing load. Magnetic interference increases load weights; therefore, crane

positioning should be done at a radius with additional factors given to the safe working load.

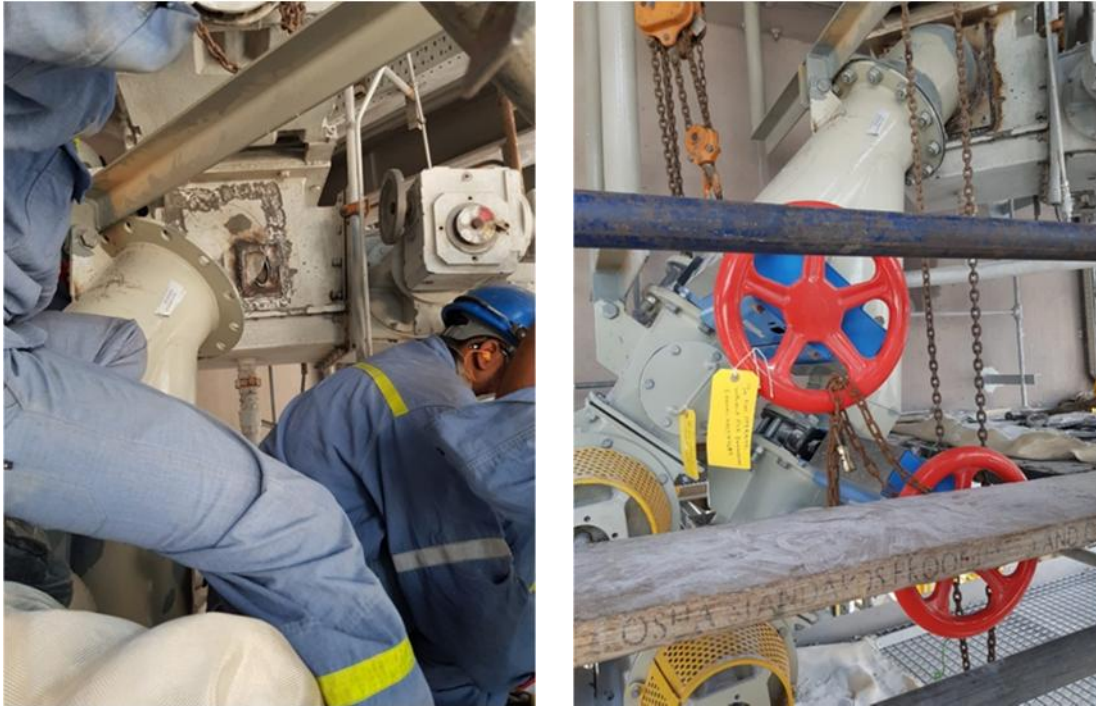


Figure 8. Left: tie-in connection work; Right: tie-in connection work.

Overall, the workforce comprised around 93 employees, with a total of lost time injury (LTI)-free work hours of more than 200 000 hours. The project is subdivided into sub-portions with a dedicated focus team at each location. More than 80 Method Statements and Risk Assessments (MSRA) were active during peak times, and 8-9 permits were managed daily on average.

4.4 Pre-Commissioning Activities

It involved the following -

- Testing and pre-commissioning, commissioning of electrical and instrumentation equipment - It includes the power-up of programmable logic controllers (PLCs), remote panels, and network system. Energisation, motor directional rotation checks, checks and inspection of field equipment. Energisation of variable frequency drive and running the variable speed motor at various speeds for supervisory control and data acquisition (SCADA), PLC-system (loop testing).
- Testing and pre-commissioning of mechanical equipment/checks and inspections of mechanical equipment un-reacted alumina silo (rotary feeders + vibrating screens), crossover air slide across the courtyard, distribution air slide, transport air slide, fluidising fans.
- Flushing off fluidising system line includes switching on the blower and flushing out the fluidising line by opening the blind flange at the end of each section separately.

An authorised person and a competent team were involved in executing the activities. Only calibrated / certified instruments had to be used. It was ensured that the circuit was not live before using the instrument. Proper communication to all personnel is to be given about testing activity. It was necessary to watch out for live panels nearby and barricade the area to keep a clearance distance from any live panel. The number of personnel inside the substation had to be limited.

Workers were trained to stay a minimum clearance distance from live panels and not touch any naked cable.

Warning signs and boards were provided, and the area was to be well barricaded. Trained and competent electricians had to perform the work.

4.5 Commissioning Activities

It involved the following -

- Opening manual gate valves above rotary feeders,
- Opening manual isolation valves in the silo area,
- Starting the fluidising air system and the start of the vibrating screen towards the pot section.
- Starting the rotary feeder and leaving some time for alumina to reach 30-pot sections,
- Checking for leakages or unusual activities,
- Repeating these steps for each 30-pot section until all pots are verified,
- After that, the plant was ready for operation.

All activities had to be done in coordination with Capital Projects/Operations. A suitable man lift/scaffold/platform was used to assist in positioning and bolting valves /equipment in the elevated area. All required operation training was conducted before performing the task. The work area had an exclusive zone with signage and banks to avoid unauthorised entry. EGA gave all the energisation for pre-commissioning activities. Any work activities carried out on systems which were not handed over to EGA were carried out as per EGA Permit to Work (PTW) systems.

5. Execution Stage – New MPPC Cranes of Double Anode Extractor Type

The contract start date was 15 June 2022 for new MPPCs. Currently there are 7 MPPCs in PL 5, and 7 MPPCs in PL 6, 1 MPPC in Eagle line and 1 MPPC in PL 9 that were 25 years old at the end of 2021, followed by others in 2022 and 2024 (Table 3). Thus, EGA envisages installing 14 new MPPCs with the latest safety features (insulation monitoring system and double braking system in metal tapping hoists as per international standards approved by EGA).

Table 3. Status of MPPCs in EGA Jebel Ali potlines 5, 6 and 9.

Potline	Crane ID	Make	No. of cranes	Year installed	25 years old in	Major inspection planned
PL 5	MPPC 01-06	NKM Noell	6	1996	2021	2021
	MPPC 07	NKM Noell	1	1997	2022	2022
PL 9	MPPC 08	NKM Noell	1	1997	2022	2022
PL 5 Eagle	MPPC 09	NKM Noell	1	1997	2022	2022
PL 6	MPPC 10-16	NKM Noell	7	1999	2024	2024

The project scope is to design, supply, deliver and install 13 new MPPCs in PL 5, PL 6, and PL 9. Those cranes must work in CD20, D20 and D20+ technology. The contractor shall design, supply, deliver and install one of the new MPPCs in PL 5 Eagle, which must work in DX+ Ultra technology. The future amperage increase possibility in potlines is also considered in the design of the MPPCs.

In the removal and dismantling of old cranes (14 units), the self-propelled modular transporter (SPMT) – Figure 9, will be used. The SPMT will also be used to deliver new cranes and pick up the old ones.

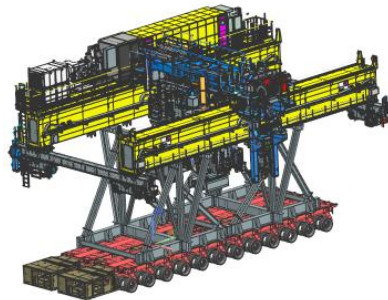


Figure 9. Self-propelled modular transporter to transport the crane.

It is planned that significant part of the assembly of cranes will be done in EGA allocated laydown area in its premises and then transported to potlines. All the major pre-commissioning activities will be done in laydown (Figure 10), and only hot commissioning with operational checks will be performed in the potlines.

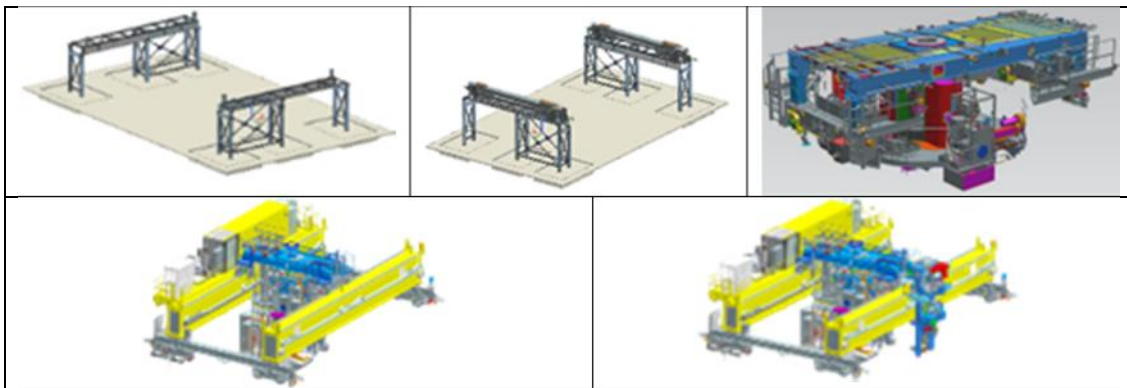


Figure 10. Assembly of crane in laydown area.

The following critical tasks were identified to be carried out on time so that the next interdependent job should not be affected. In November 2022, the design review and HAZOP session of the Pot Feed System was also completed to ensure that the design meets the plant safety standards.

5.1 Engineering

The MPPC design will include the following:

- A long travel structure of a twin girder unit design,
- A tending tools trolley located between the two girders,
- One cantilever-guided hoist trolley will be located on the girder side.

The new MPPC is designed to suit the operational requirements of different areas in potrooms to perform the following functions:

- Anode changing,
- Anode dressing,
- Bath and metal tapping and crucible tilting,
- Transportation and setting of anode beam raising equipment,

- Cavity cleaning,
- Crust breaking,
- Tap hole breaking,
- Automatic anode levelling design.

Every crane must be equipped with an appropriate access platform that will allow potroom light, potroom speaker maintenance and/or complete replacement of the lamp and disconnections of the whole light assembly, including the power supply plug with safety from the crane top.

To complete the engineering on time, the following tasks were completed.

- Site inspection and measurements to validate the following interfaces during the crane design and which are –
 - Detailed survey of existing buildings,
 - Roof filling,
 - Building internal interfaces (min clearances required),
 - Fume duct inside the building (at various locations),
 - Transfer gantry (north and south),
 - Conductor rails,
 - Crane rails (worn-out rails, Brownfield tolerances, anti-derail tracking),
 - Crane wheels and guide roller interface with rail clip bolts height,
 - Superstructure,
 - Building cross-section with potshell,
 - Superstructure with anode beam raising equipment on top,
 - Superstructure lifting frame,
 - Anode burnout puller,
 - Metal crucibles,
 - Bath crucibles,
 - Aluminium fluoride vehicles,
 - Anode pallet,
 - Pot feed interface (specially on duct side),
 - Anode assembly on the pot with minimum and maximum height,
 - Cathode interface (min and max) for cavity scoop,
 - Pot shell and superstructure assembly for bath covering,
 - Jack hammer reach to end anode and centre channel
 - Pot hoods,
 - Crane maintenance bays,
 - J-hook and anode clamp.

These interface checks require the usage of three-dimensional (3D) scanners. It requires setting up the tripod at the necessary location and then setting up the scanner equipment above this tripod. Only trained employees were allowed access to the operation area, and work permit was to be issued before the start of the work. Extra care is to be taken when carrying equipment due to the high magnetic field—precautions required related to dust, noise, crane movement and any electrical hazards.

- There was a delay in engineering due to the finalisation of the electrical load, as it required a survey of potlines down shop conductors (DSC) protection devices to verify ratings, type/reference, and settings at around 40 locations. It required short shutdowns to retrieve maximum data from the site. Full body harness with double lanyard and 100 % anchored on anchoring point and working at height training to open the electrical panel door and isolate the power supply.
- General arrangement (GA) drawings, electrical load list, long travel access and validation drawing, termination diagrams, cable schedule, single line diagram, shovel drawing

validation and filling station electrical diagram modification were also completed on time. There was a slight delay in completing engineering from the agreed baseline schedule.

- The safety latch (Figure 11) was a prototype and hook latch motion controlled from the radio remote, where the operator should maintain the command button to open the latch. It was actuated pneumatically. Hence its successful testing was necessary for an existing old crane hoist before implementing it in all the hoists of new cranes. The safety latch installation, trial, testing, training, and operation were successful.

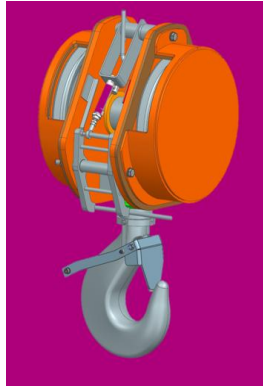


Figure 11. Safety latch.

5.2 Procurement and Manufacturing

It includes the -

- Manufacturing of long travel trolleys locally in Dubai,
- Tapping trolley works locally in Abu Dhabi,
- Finishing cross trolley,
- Completing the assembly of the end truck,
- Assembly of wheels for the trolleys,
- Welding of mast for crust breaker assembly, welding mobile lifting trunk, welding and machining for parts around the drum (spindles and bearings), and welding shovel fixed frames,
- Machining of the core turret,
- Assembly of bath pipes,
- Assembly of guides,
- Binding of shafts and wheels,
- Procurement of cabin, junction boxes and related components for electrical room,
- Cabling of the electrical room.

During manufacturing, post-COVID, the main constraint was to issue orders to sub-contractors on time to avoid price escalation. Also, the procurement, manufacturing and assembly were planned in different parts of the world. It required that quality should not be compromised, and components should be delivered on time to the following user in the chain.

5.3 Smart Crane

SMART Crane is an optional solution dedicated to end users of aluminium smelters in the fields of operations, maintenance, and process. They can anticipate and perform preventive maintenance actions, improving equipment availability, optimising production operations and their impact on the process.

5.3.1 Smart Crane Benefits

Operation:

Dashboard page

- Crane fleet availability graphs and statistics,
- Operating mode of the crane fleet,
- Recent major events on the crane.

Machine Dashboard page

- Crane availability graphs and stats (crane by crane details),
- Crane availability per week graph.

Live Operation

- Anode change quantity (during current shift),
- Anode covering quantity (during current shift),
- Tapping quantity and metal weight (during current shift),
- Current shift: list of operation events (anode change, anode adjustment, filling, covering, anode beam raising, metal tapping, tapping hole, etc.),
- Previous shift: list of operation events (anode change, anode adjustment, filling, covering, anode beam raising, metal tapping),
- Export to Excel feature.

Anode change details (for any single anode change)

- Pot Tending Machine (PTM)#, team, shift, anode change duration, braking quantity, shoveling quantity, gauging used or not,
- Detection, anode change sequence event detection (breaking after extracting, breaking after shoveling),
- Crane movement graph (using VFD feedback),
- Signal timeline: understand sequence of actions from operator,
- Operator Safe Operating Practice (SOP) compliance verifications.

Tapping details (for any single Metal Tapping)

- Duration / metal tapped (kg),
- Graph representing: metal weight, metal flow, ejector, tapping hoist height.

Production Analysis

- Analyse past data about crane operation (anode change, metal tapping, etc.),
- Export in CSV any data table.

Crane Location

- Room # detection, pot # detection, anode # detection, filling station # detection,
 - Anode change details: know exact trajectory of your crane during anode change,
 - Anode change history: Add crucial information such as pot #, anode#, breaking pattern,
 - Anode change history: follow up on specific anode (corner anode).

5.3.2 Maintenance

Live Maintenance

- Live view of Maintenance Key performance indicators (KPIs) per crane,
- Crane access stop status,
- Crane doors status,
- Crane insulation status,
- Tools usage % during current shift.

CANDI 4.0 (Insulation Monitoring)

- Live view graph of each insulation level of each crane,
- Tendencies of insulation level,
- Insulation reliability KPI: Overall graph view of the reliability about your PTM insulation level.

Customisable Dashboard

- Create own dashboard without the need of supplier,
- Explore on a visual way, all the data stored in SMART Crane,
- Correlate data from operation and maintenance to understand specific scenarios,
- Support your tap root for incident / frequent breakdown by visual way to monitor data.

Fault List

- Alarms and faults history to enable deep analysis,
- Capture of every single alarm and fault that occurred on any of the crane,
- Filter by date, duration, occurrences, status (maintenance or Production), equipment, description,
- Export to CSV alarm and list.

Fault Analysis

- Pie chart of the top 5 faults and alarms (cumulated fault time, occurrences).

Parameters

- Table of crane parameters such as hydraulic unit parameters,
- See parameters change history.

Maintenance page

- Create specific cycle counters or running hours meter to monitor crane equipment cycle and life time.

Crane page

- KPIs and meters of crane elements (motors, cylinders, valves, running hours etc...).

VFD monitoring

- Live view of VFD status,
- Graph live view of VFD parameters (current, frequency, speed).

Automatic Email Report

- Get automatic email report with the data you need inside:
 - Example for operation: Get an email every shift with the standard operating procedure (SOP) deviation. Get email with summary of production activities.
 - Example for maintenance: Get an email with downtime per crane each shift.

5.4 Construction

The project construction will commence from November 2023 and continue until the second quarter of 2024; there will be two separate laydowns for the Fives team. One site will be allocated for assembling new cranes, and the other will be disassembling old cranes. More than 100 personnel from the contractors' are expected to be mobilised. The main challenge will be to complete the mobilisation of resources on time, with the completion of necessary training. All the approvals for allocating the offices and laydown have been obtained.

Since the work involves the movement of high-load trailers across the region, plant site and country roads, the approval from the municipality and road authorities should be taken, with various interface/clash checks at all road roundabouts.

Similarly, the movement of assembled cranes from laydown to the pot room installation site should also be planned carefully with approvals from infrastructure, cast house and reduction departments. The method statement and risk assessment (MSRA) should capture the load impact on the roads and over the corridors in the plant, with vehicle movement across the hot metal road areas.

The crane positioning during installation in the pot room area should be checked for the impact of the magnetic field. After that, the focus will be training the existing 140 operation employees from old cranes to new, fully automatic cranes with the latest technology. This should be done smoothly and planned with all stakeholders so that training and crane handover will be done on time, with no safety incidents.

5.5 Pre-Commissioning and Commissioning Activities

Pre-commissioning will consist of energising and performing energised functional tests without introducing the product. All the related checks will be performed in the laydown area.

Commissioning will consist of energised functional tests with the introduction of process product followed by production ramp-up, performance testing and reliability testing in compliance with the specifications and approved commissioning plan and procedures.

6. Conclusion

Overall, the project had significant challenges when it was tendered during the peak COVID times in the year 2020, and the initial vendor assessment was also done in China during that time using advanced camera viewing to assess the capability. The execution was done closely with the contractor, projects, operation, maintenance and Environment Health Safety (EHS) team. There are several foreseen challenges in the induction of new modern cranes (where the operators are using 25-year-old cranes), movement, the introduction of new cranes and removal/dismantling of old cranes (multiple times). The Pot Feed System project is expected to complete in February 2024, and the new MPPC project will be completed by June 2025.