

Sellafield BEP In-cell Handlers and 60t PHC

The Sellafield Box Encapsulation Plant (BEP) In-cell handlers and 60t Package Handling Crane (PHC) refurbishment project commenced in 2015. The project entailed the refurbishment of:

- **60t PHC, including a 10t maintenance Aux Hoist**
- **10t Box Operation Cell Handler Crane**
- **5t Long Wheelbase (LWB) Waste Treatment Cell (WTC) Handler (uprated to 10 tonne)**
- **2t Short Wheelbase Waste Treatment Cell Handler (uprated to 10 tonne)**



The works included a detailed review of the existing structures, equipment, and the overall current condition of the cranes. Once the condition was established, the Clarke Chapman - Wellman Booth Division's mechanical and electrical engineering design teams set to work revising the existing design to comply with the latest standards and to include new components due to Learning From Experience (LFE), from a similar previous project a few years earlier (BEPPS/DIFF Vault Cranes).

Whilst utilising the majority of existing mechanical structures and devices, the electrical system on all cranes were replaced with a new design, including a partial design to safety standard BS EN 61508 implemented onto the 60t PHC. Each of the crane designs included for a panel suite of multiple bays, the 60t panel suite designed to be located onboard, mounted onto the girder's, with access for maintenance, whereas the three handler panel suites were designed to be off board the cranes due to the space restrictions.

Once completed, the mechanical and electrical designs including supporting documentation (calculations, Programmable Logic Controller (PLC) software specifications, etc.) were approved through the client's team. Due to the significance of the 60t PHC, a review by an independent third party and by the Nuclear Decommissioning Agency, after which our procurement and production activities could commence.

The 60t PHC is designed to be operated through a pendant controls system, with interlocks that allow the crane to operate at certain speeds and limits of operations in specific zones. The zones are triggered through wall targets that activate a proxy sensor informing the cranes controls of its location. In the event of any of the safety devices being activated the crane has a complex backout procedure including a key switch system to limit only the necessary operations to safely recover from a trip condition. A few examples of the safety devices on board the 60t PHC are, snagged and ledged load protection through tilt switches, overload detection through loadcells, over-raise and travel detection through limit switches, barrel monitoring devices, and protection of dropped load through the Hubbell Overspeed switch.

The handlers are of a similar design and each operated through a PLC. However, the LWB and SWB handlers operate within the same cell (WTC) on the same rails. Given they do not 'talk' to each other, to use both on the same rails presented design challenges to ensure they could function safely. The solution was one set of wall targets and a positional rack system down one side of the cell for one handler and a set along the opposite side for the second handler.

With the respective positions controlled by the PLC, thus preventing any collisions, this allowed each to be used independently but simultaneously. Fitted with unique stainless-steel grapples to enable lifting of the packages via the use of twistlocks. A flag is located on the grapple activates once the twistlocks are landed, engaged and mechanically locked providing the operator a clear status of the lifting arrangement prior to lifting via the onboard camera system. The LWB and SWB have further secondary grapples which interlock with the primary grapple through the twistlocks to enable different packages to be lifted.

A recovery drive system which allows the operator to manually take control of the handler, and in creep mode, the handler is moved into the correct cross travel location. From where, using the rabbit recovery system and winches, the handler can then be manually withdrawn into the maintenance area.

Working to a tight schedule, the project and procurement team engaged with, and monitored progress of key suppliers, reviewing QA records, and witnessing testing to ensure

the equipment met the project requirements prior to assembly. During manufacture and due to operational changes, our client's design team implemented a change of scope to redesign the panels. Through coordination with the supplier as well as our design team to ensure that the design was updated, the modification were incorporated with minimal impact to the overall programme.

The handlers were assembled at component level (trolley, girders & end carriages) at low level before being placed onto temporary gantries. This enabled the cranes to simulate the site working conditions, including the two WTC handlers being located on the same gantry. The factory acceptance testing involved our own team of commissioning engineers setting the devices and drives to the correct parameters to enable the PLC to control and provide the correct functional operation of the handlers. Once completed, the client's own team took ownership of the cranes, the work area and using dummy packages and pack stands they simulated site operations. LFE gathered was then incorporated, specifically into the panels and onto the grapples.

Due to size, it was not possible to test the Long Travel (LT) movements of the 60t PHC. However, it was built at low level with the trolley placed onto the girders enabling the trolley Cross Travel (CT) movement testing. The trolley was then moved to a high-level test gantry and load testing undertaken, proving correct engagement of the cam switches and that the overspeed device would trip and stop the load in a timely manner.

Following successful testing, each crane was strategically dismantled for transport, whilst retaining as much of the electrical connections as possible to reduce site reworks. Once at site and reassembled at low level, each crane was installed in their respective positions. The 60t PHC required the building roof to be removed and lowered onto the gantry whilst the handlers had the gantry extended outside the cell and rolled into position.

Factory Acceptance Test (FAT) documentation and quality records were produced and accepted by Sellafield Limited. We are just moving into the Site Acceptance Test (SAT) and commissioning phase.



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