



Glovebox Suite

Client: Jacobs - DSRL

Aims and objectives

Jacobs commissioned Cyclife Aquila Nuclear Engineering to design and deliver two engineered glovebox suites to Dounreay, to enable the safe inspection and repackaging of materials.



Containment

Cyclife EDF Group - Subsidiaries





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The client

Jacobs provides performance-driven solutions throughout the asset life cycle, from concept to decommissioning across a broad range of industrial markets including the upstream, midstream and downstream oil & gas, power & process, environment and infrastructure, clean energy, mining, nuclear, and general industrial sectors.

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Project overview

This glovebox suite comprises a series of connected gloveboxes and a single fume cupboard with Commercial Off-The-Shelf (COTS) work benches. This glovebox suite was designed to be the primary containment for the re-packaging of cans.

The glovebox suite was designed to Sellafield's Technical Standard ES_0_1503_1 - Issue 1 - Design of Alpha Glovebox Plant and Equipment with attention to the following elements:

- Radiological Protection
- Seismic Qualification
- Glovebox Containment
- Glovebox Shell
- Glovebox Support Frame
- Glovebox Window & Port Arrangements
- Services



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Cyclife Aquila designed, manufactured and ran factory acceptance testing.

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Full Specification

Seismic Qualification

Seismic qualification was carried out for the complete system to have a design basis earthquake (DBE) to withstand of $1.00E-02$ / y return frequency. A $1.00E-02$ / y (1 in 100 years) DBE equates to a peak ground acceleration (PGA) of 0.02g.

Glovebox Shell

The glovebox suite shell design uses the Sellafield standards for alpha containment design. Glovebox shells were fully welded 304L stainless steel boxes with openings for windows, filters, penetrations and bag ports etc. The primary function of the shell was to provide containment of the nuclear material and is the primary boundary between the material and the operator. The shell was, for the most part, 6mm thick, with a 25mm thick base plate. All window openings were reinforced with 20mm thick window frame, window mounts drilled and tapped to accept the containment window complete with gasket, bolts and window frame.

Glovebox Containment

The glovebox was designed and built to Category 2 as per ES_O_1503_1 - Issue 1 and required a high integrity leak rate test which achieves a leak rate of less than 0.05% glovebox volume/hour at a pressure of 10 mbar or depression of 10 mbar, with all glove ports suitably sealed. Glovebox ventilation and extract systems were being supplied by others.

Glovebox Windows and Port Arrangements

The containment windows were constructed using 12mm thick Lexan polycarbonate and follow Sellafield standards for the design of alpha containment gloveboxes. The mounting method and design of the window frames were in accordance with the Sellafield standard design. This comprises of a flat faced window frame welded to the glovebox shell, a flat gasket and Lexan window, both of which are sandwiched by a castellated window clamping frame.

There were 4 window variants; light window, containment window, 4 glove port window and 6 glove port window. The glove port arrangements on the glovebox suite windows were positioned such that operations and maintenance could be performed safely and successfully, without placing undue strain on the operator.

Services

In accordance with ES_O_1503_1 - Issue 1 Design of Alpha Glovebox Plant and Equipment specification services were placed outside the glovebox up to the point where internal services were essential. The connections to the glovebox were by means of integral weld-on features. Provision for future Argon purging was included in one of the gloveboxes through a weld in boss.

Power & Instrument Cable & Lighting

These were standard proprietary hermetically sealed plugs and sockets sealed to the box shell by locknut and 'O' ring seal or flat gasket. Fischer type connectors were selected to maintain containment and provide reliable electrical connections.

The glovebox suite was designed to have enough light windows and fluorescent lighting to ensure a minimum of 700 lux was achieved for inspection and detailed working and 300 lux for general operations and maintenance. All lighting was mounted externally to the glovebox.



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Summary

The glovebox suite was designed, manufactured and factory acceptance tested by Cyclife Aquila, to meet the performance requirements relating to: air flow, depression, oven, furnace, weigh scales, moisture analyser, HVAC, and instrumentation.

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